

commixta, opposita vel alternata, ampullacea, curvata, 14–25 × 7–9 μ , collo suberecto, 3 μ crasso praedita. Setae myceliales numerosae, dispersae, erectae, rectae, simplices, acutae, usque ad 250 × 9–11 μ . Perithecia dispersa, atra, globosa, verrucosa, usque ad 180 μ diam. Sporae atrobrunneae, cylindratae, obtusae, 4-septatae, constrictae, 40–47 × 15–17 μ .

Hab. in foliis *Wormiae atatae*, Johnstone R., Qld., Bailey 484.

Colonies epiphyllous, black, dense, up to 4 mm. diam., somewhat velvety. Mycelium of substraight dark brown hyphae, 7 μ thick, the cells mostly 15–30 μ long, branching opposite at 45°, forming a very dense and almost solid network. Capitate hyphopodia opposite or alternate, somewhat antrorse, usually straight, 11–17 μ long; stalk cell cylindrical, 2–6 μ long; head cell globose, entire, 10–13 μ diam. Mucronate hyphopodia mixed with capitate, opposite or alternate, bent ampulliform, 14–25 × 7–9 μ , neck erect, 3 μ thick. Mycelial setae numerous, erect, straight, simple, acute, up to 250 × 9–11 μ . Perithecia scattered, black, globose, verrucose, up to 180 μ diam. Spores dark brown, cylindrical, obtuse, 4-septate, constricted, 40–47 × 15–17 μ .

Family EBENACEAE.

(7) MELIOLA DIOSPYRICALA Hansf., n. sp. (3113.4233). (Fig. 6.)

Plagulae amphigenae, plerumque hypophyllae, densae, velutinae, usque ad 4 mm. diam., interdum confluentes. Mycelium in epiphylo ex hyphis subrectis vel leniter undulatis, atrobrunneis, 6–7 μ crassis (cellulis plerumque 15–25 μ longis), opposita ramosis (60–90°), subdense reticulatis compositum. Hyphopodia capitata alternata vel circa 3% opposita, plus minusve antrorsa, recta vel curvula, 16–24 μ longa, cellula basali cylindrata, 4–9 μ longa, cellula apicali ovata vel cylindrata, integra, superne saepe leniter recurvata, 11–18 × 8–11 μ . Hyphopodia mucronata illis capitatis commixta, alternata vel opposita, conoidea vel ampullacea, 15–25 × 7–8 μ , collo suberecto, 3–4 μ crasso praedita. Setae myceliales numerosae, dispersae, erectae, rectae, simplices, acutae vel subacutae, usque ad 750 × 9–11 μ . Perithecia dispersa, atra, globosa, verrucosa, usque ad 240 μ diam. Sporae atrobrunneae, cylindratae vel subellipsoideae, obtusae, 4-septatae, constrictae, 40–48 × 16–19 μ .

Hab. in foliis *Diospyri australis*, Williams R., N.S.W., Fraser 104A (typus in Herb. Dept. Agric., Sydney); *loc. cit.*, Fraser 104; National Park, N.S.W., Fraser 156.

Colonies amphigenous, mostly hypophyllous, dense, velvety, up to 4 mm. diam., usually smaller and sometimes confluent. Mycelium on upper surface of substraight to slightly undulate dark brown hyphae 6–7 μ thick, the cells mostly 15–25 μ long, branching opposite at wide angles, closely reticulate. On the lower leaf surface the mycelium is much more crooked and irregular. Capitate hyphopodia alternate or about 3% opposite, more or less antrorse, straight or bent, 16–24 μ long; stalk cell cylindrical, 4–9 μ long; head cell ovate to cylindrical, often slightly recurved at the tip, entire, 11–18 × 8–11 μ . Mucronate hyphopodia mixed with capitate, alternate or opposite, conoid-ampulliform, 15–25 × 7–8 μ , neck upturned, 3–4 μ thick. Mycelial setae numerous, scattered, erect, straight, simple, acute or subacute, up to 750 × 9–11 μ . Perithecia scattered, black, globose, verrucose, up to 240 μ diam. Spores dark brown, cylindrical, obtuse, 4-septate, constricted, 40–48 × 16–19 μ .

(8) MELIOLA DIOSPYRI-PENTAMERAE Hansf., n. sp. (3113.6333). (Fig. 7.)

Plagulae amphigenae, densae, velutinae, usque ad 3 mm. diam. Mycelium in epiphylo ex hyphis atrobrunneis, subrectis vel leniter undulatis, 7–8 μ crassis (cellulis plerumque 20–25 μ longis), opposita vel irregulariter ramosis (30–60°), dense reticulatis compositum, in centro plagularum subsolidum. Hyphopodia capitata alternata, saepe curvata, 22–40 μ longa, cellula basali cylindrata, 5–15 μ longa, cellula apicali irregulariter lobata et curvata, 17–26 × 10–19 μ . Hyphopodia mucronata illis capitatis commixta, alternata, conoidea vel ampullacea, 24–29 × 7–9 μ , collo suberecto, 3–4 μ crasso praedita. Setae myceliales paucae vel numerosae, dispersae, erectae, simplices, acutae, usque ad 600 × 8–11 μ . Perithecia dispersa, atra, globosa, verrucosa, usque ad 240 μ diam. Sporae atrobrunneae, cylindratae vel subellipsoideae, 4-septatae, constrictae, 50–59 × 19–23 μ .

Hab. in foliis *Diospyri pentameræ*, Tweed R., N.S.W., Fraser 53 (typus in Herb. Dept. Agric., Sydney); Mt. Warning, N.S.W., Fraser s.n.; Williams R., N.S.W., Fraser 140, 202.

Epiphyllous colonies are dense, up to 2 mm. diam., with few setae, probably due to parasites. Mycelium of substraight to slightly undulate dark brown hyphae, 7–8 μ thick, the cells mostly 20–25 μ long, branching opposite or irregular at wide angles, densely reticulate and becoming almost solid. Capitulate hyphopodia alternate, often bent, 22–40 μ long; stalk cell cylindrical, 5–15 μ long; head cell very irregularly bent and lobed, 17–26 \times 10–19 μ . Mucronate hyphopodia mixed with capitulate, alternate, conoid-ampulliform, 24–29 \times 7–9 μ , neck upturned, 3–4 μ thick. Mycelial setae few scattered, erect, straight, simple, acute, up to 600 \times 8–11 μ . Perithecia scattered, black, globose, verrucose, up to 240 μ diam. Spores dark brown, cylindrical to subellipsoid, 4-septate, constricted, 50–59 \times 19–23 μ .

The hypophyllous colonies are more velvety, slightly larger, the hyphae more crooked, and the hyphopodia less lobed but more variable in shape and size, from globose and entire to ovate and often somewhat pointed at the apex, with others irregularly rounded-angular and often sharply curved to almost uncinata, 13–25 \times 10–15 μ . The stalk cells vary in length from 5–30 μ and are often much bent. The spores are variable, occasional ones are only 45 μ long, while others reach 62 μ . Colonies of this species also occur on *Diospyros australis*, Williams R., N.S.W., Fraser 104, on the underside of the leaf only.

In many characters this species resembles the description of *M. megalocarpa* Syd., on *Maba buxifolia*, Philippines, but differs especially in that the hyphopodia of the latter are given as oblong and entire. Specimens of Sydow's species have not yet become available to me for comparison.

Family EPACRIDACEAE.

(9) *MELIOLA CYATHODIS* Hansf., in *Proc. Linn. Soc. London*, 157: 180, 1946 (2111.6232).

Colonies hypophyllous, rather thin, up to 2 mm. diam. Mycelium of dark brown, flexuous to sinuous hyphae, 7–9 μ thick, the cells mostly 10–30 μ long, branching usually opposite at acute angles, loosely to rather closely reticulate. Capitulate hyphopodia alternate or less than 1% opposite, more or less antrorse, straight or bent, 25–35 μ long; stalk cell cylindrical, 7–14 μ long; head cell very irregularly 2–5-lobed or merely angular, often bent, 15–25 \times 10–20 μ . Mucronate hyphopodia scattered amongst the capitulate, few, alternate, bent ampulliform, 18–22 \times 7–9 μ , neck upturned, 3–4 μ thick. Perithecia in a central group, black, globose, verrucose, up to 240 μ diam. Spores dark brown, cylindrical to ellipsoid, bent, the ends more or less attenuate-rounded, 3-septate, constricted, 53–63 \times 16–18 μ .

On leaves of *Cyathodes glaucus*, Tasmania, L. Rodway 421 (type in Herb. Pretoria).

(10) *MELIOLA CYATHODIS* Hansf., var. *TROCHOCARPAE* Hansf., n. var. (2113.5241). (Fig. 8.)

Plurulae amphigenae, plerumque hypophyllae, subsensae, leves, usque ad 2 mm. diam. Mycelium ex hyphis atrobrunneis, undulatis, 6–7 μ crassis (cellulis plerumque 20–25 μ longis), opposita vel irregulariter ramosis (60–90°), dense reticulatis compositum. Hyphopodia capitata alternata vel circa 1% opposita, plus minusve antrorsa, recta vel varie curvata, 22–35 μ longa, cellula basali cuneata vel cylindracea, 6–20 μ longa, cellula apicali rotundato-lobata, versiformia, 15–23 \times 12–18 μ . Hyphopodia mucronata illis capitatis commixta, plerumque alternata, ampullacea, curvata, 14–20 \times 6–9 μ , collo suberecto, 3–4 μ crasso praedita. Setae myceliales paucae, juxta perithecia evolutae, erectae, rectae vel flexuosae, simplices, obtusae, usque ad 200 \times 6–8 μ . Perithecia laxa aggregata, atra, globosa, verrucosa, usque ad 350 μ diam., cellulis parietis conoideis vel mammillatibus, usque ad 30 μ alt. et inferne circa 50 μ diam. Sporae atrobrunneae, ellipsoideae, curvatae, 3-septatae, constrictae, 45–54 \times 16–18 μ , cellulis terminalibus minoribus et rotundato-conoideis.

Hab. in foliis *Trochocarpae laurinae*, Williams R., N.S.W., Fraser s.n. (typus in Herb. Dept. Agric., Sydney); Bulga, N.S.W., Fraser 63.

Colonies amphigenous, mostly hypophyllous, rather dense, smooth, up to 2 mm. diam. Mycelium of undulate dark brown hyphae 6-7 μ thick, the cells mostly 20-25 μ long, branching opposite or irregular at wide angles, closely reticulate. Capitata hyphopodia alternate or about 1% opposite, more or less antrorse, straight or variously bent, 22-35 μ long; stalk cell cylindrical-cuneate, 6-20 μ long; head cell irregularly rounded-lobate, versiform, 15-23 \times 12-18 μ . Mucronate hyphopodia mixed with capitata, mostly alternate, bent ampulliform, 14-20 \times 6-9 μ , neck upturned, 3-4 μ thick. Mycelial setae very few, around the perithecia, erect, straight or upcurved, simple, obtuse, up to 200 \times 6-8 μ , sometimes flexuous and descending to the mycelium. Perithecia in loose central group, black, globose, up to 350 μ diam., the surface cells conoid-mammillate, projecting about 30 μ and about 50 μ diam. at the base. Spores dark brown, bent ellipsoid, 3-septate, constricted, 45-54 \times 16-18 μ , the end cells smaller than central cells and rounded-conoid.

This variety differs from the type in its denser colonies, obtuse setae around the perithecia only, larger perithecia and considerably smaller spores, which tend to be more fusoid.

Family EUPHORBIACEAE.

(11) MELIOLA PETALOSTIGMATIS Hansf., n. sp. (3113.4232). (Fig. 9.)

Plagulae epiphyllae, densae, usque ad 1 mm. diam., velutinae. Mycelium ex hyphis atrobrunneis, subrectis, 6-7 μ crassis (cellulis plerumque 15-20 μ longis), opposita ramosis (30-60°), dense reticulatis compositum, in centro plagularum subsolidum. Hyphopodia capitata alternata vel opposita, plus minusve antrorsa, recta vel curvata, 14-23 μ longa, cellula basali cylindracea, 3-7 μ longa, cellula apicali ovata, ellipsoidea vel piriformia, apice late rotundata, integra, recta vel curvula, 10-16 \times 7-10 μ . Hyphopodia mucronata numerosa, illis capitatis commixta, ampullacea, curvata, 15-20 \times 7-8 μ , collo suberecto, 3 μ crasso praedita. Setae myceliales praecipue juxta perithecia evolutae, erectae, rectae, simplices, obtusae vel subacutae, usque ad 350 \times 7-8 μ . Perithecia laxe aggregata, atra, globosa, verrucosa, usque ad 240 μ diam. Sporae atrobrunneae, cylindraceae vel ellipsoideae, obtusae, 4-septatae, constrictae, 36-44 \times 15-17 μ .

Hab. in foliis *Petalostigmatis quadrilocularis*, Lawrence, N.S.W., Fraser 229, in Herb. Dept. Agric., Sydney.

Colonies epiphyllous, dense, up to 1 mm. diam., becoming velvety. Mycelium of substraight dark brown hyphae 6-7 μ thick, the cells mostly 15-20 μ long, branching opposite at acute angles, densely reticulate and almost solid in the centre. Capitata hyphopodia alternate or opposite, more or less antrorse, straight or bent, 14-23 μ long; stalk cell cylindrical, 3-7 μ long; head cell ovate, ellipsoid to piriform, broadly rounded at apex, entire, straight or slightly bent, 10-16 \times 7-10 μ . Mucronate hyphopodia numerous, mixed with capitata, bent ampulliform, 15-20 \times 7-8 μ , neck upturned, 3 μ thick. Mycelial setae mostly around perithecia, erect, straight, simple, obtuse to subacute, up to 350 \times 7-8 μ . Perithecia in loose central group, black, globose, verrucose, up to 240 μ diam. Spores dark brown, cylindrical to subellipsoid, obtuse at ends, 4-septate, constricted, 36-44 \times 15-17 μ , mostly about 39 \times 15 μ .

(12) IRENOPSIS CROTONIS (Stev. & Tehon) Stev., in *Ann. Mycol., Berlin*, 25: 441, 1927 (3401.3220).

Colonies amphigenous, thin, smooth, up to 5 mm. diam. or sometimes confluent. Mycelium of substraight to slightly undulate dark brown hyphae, 6-7 μ thick, the cells mostly 25-40 μ long, branching opposite at acute angles, loosely reticulate-radiating. Capitata hyphopodia alternate, antrorse, usually straight, 13-20 μ long; stalk cell cuneate to cylindrical, 4-7 μ long; head cell globose to piriform and entire, or sometimes rounded-angulose and slightly irregular, 10-13 \times 9-11 μ . Mucronate hyphopodia mixed with capitata, alternate or opposite, bent ampulliform, 18-24 \times 6-8 μ , neck upturned, 3 μ thick. Mycelial setae none. Perithecia loosely scattered, black, globose, verrucose, up to 160 μ diam., with 2-10 erect-spreading setae on upper half; setae simple, obtuse, thick-walled, continuous, smooth, up to 120 \times 6-10 μ , apex nearly straight or uncinately but not coiled. Spores dark brown, cylindrical, obtuse, 4-septate, constricted, 33-38 \times 14-16 μ .

On *Croton verreauxii*, Williams R., N.S.W., Fraser s.n., April, 1952.

(13) *IRENINA MALLOTTI* Hansf. & Thirum., *Farlowia* 3: 289, 1948 (3101.5330).

Colonies hypophyllous, less commonly also epiphyllous, up to 4 mm. diam. or sometimes confluent, rather dense. Mycelium of substraight to undulate dark brown hyphae 6–8 μ thick, the cells mostly 20–35 μ long, branching opposite or irregular, loosely to rather closely reticulate. Capitulate hyphopodia alternate, at varying angles, straight or often bent, 14–30 μ long; stalk cell cylindrical, 5–12 μ long; head cell clavate or irregularly rounded-angulose, rarely sublobate, 10–20 \times 11–16 μ . Mucronate hyphopodia mixed with capitulate, alternate or sometimes opposite, bent conoid-ampulliform, 17–22 \times 7–10 μ , neck upturned, 4–5 μ thick. Mycelial setae none. Perithecia scattered, black, globose, up to 230 μ diam., the surface cells mammillate to obtusely bent-conoid, projecting up to 30 μ . Spores dark brown, subellipsoid, obtuse, 4-septate, constricted, 48–55 \times 19–24 μ .

On *Batoghia lucida*, Williams R., N.S.W., Fraser 148, 219.

Family FLACOURTIACEAE.

(14) *MELIOLA SCOLOPIAE* Doidge, var. *ZEYLANICA* Hansf., in *Proc. Linn. Soc. Lond.*, 158: 35, 1946 (2111.5334).

Colonies amphigenous, dense, up to 2 mm. diam. or sometimes confluent, velvety. Mycelium of dark brown, more or less undulate hyphae 7–9 μ thick, the cells mostly 15–20 μ long, branching alternate or irregular, rarely opposite, closely reticulate. Capitulate hyphopodia alternate, straight or bent, 20–35 μ long; stalk cell cylindrical, 6–15 μ long; head cell deeply 3–6-lobed, straight or very irregularly bent, 15–25 \times 15–25 μ . Mucronate hyphopodia few, alternate or unilateral, scattered amongst capitulate, conoid-ampulliform, bent, 18–25 \times 7–8 μ , neck upturned, 3–4 μ thick. Mycelial setae numerous, scattered and also around the perithecia, erect, more or less straight, simple, obtuse to subacute, up to 1100 \times 9–11 μ . Perithecia scattered, black, globose, verrucose, up to 240 μ diam. Spores dark brown, bent ellipsoid, obtuse, 3-septate, constricted, 53–59 \times 18–22 μ .

On *Scolopia brownii*, Williams R., N.S.W., Fraser 105, 203 p.p.

The range of spore size is greater in the Australian material than in the type from Ceylon, and occasional spores reach a length of 69 μ .

Family GESNERIACEAE.

(15) *IRENOPSIS FIELDIAE* Hansf., n. sp. (3401.3220). (Fig. 10.)

Plagulae epiphyllae, tenues, leves, usque ad 1 mm. diam. vel. confluentes. Mycelium ex hyphis atrobrunneis, undulatis vel flexuosis, 6–8 μ crassis (cellulis plerumque 15–30 μ longis), opposita vel irregulariter ramosis, laxe reticulatis compositum. Hyphopodia capitata alternata, rarissime opposita, plus minusve antrorsa, recta vel curvata, 17–25 μ longa, cellula basali cylindracea, 4–9 μ longa, cellula apicali interdum ovata integraeque, interdum rotundato-angulosa vel lobata, versiformia, 14–18 \times 9–14 μ . Hyphopodia mucronata in hyphis distinctis evoluta, opposita, ampullacea, curvata, 13–18 \times 6–8 μ , collo suberecto, 3–4 μ crasso praedita. Setae myceliales nullae. Perithecia laxe dispersa, atra, globosa, verrucosa, usque ad 160 μ diam., superne setis 2–12, erecto-patentibus, rectis vel subrectis, simplicibus, obtusis vel subacutis, 3–4-septatis, usque ad 180 \times 7–8 μ , sursum attenuatis ornata. Sporae atrobrunneae, cylindraceae, obtusae, 4-septatae, constrictae, 32–39 \times 13–15 μ .

Hab. in foliis *Fieldiae australis*, Mt. Wilson, N.S.W., Fraser 5 (typus in Herb. Dept. Agric., Sydney); Comboyne, N.S.W., Fraser 190; Blackheath, N.S.W., Fraser 210.

Colonies epiphyllous, closely scattered, up to 1 mm. diam., thin, smooth, sometimes confluent. Mycelium of crooked dark brown hyphae 6–8 μ thick, the cells mostly 15–30 μ long, branching opposite or irregular at varying angles, loosely reticulate. Capitulate hyphopodia alternate, very rarely opposite, more or less antrorse, straight or bent, 17–25 μ long; stalk cell cylindrical, 4–9 μ long; head cell sometimes ovate and entire, more often shallowly rounded-lobate or irregular, versiform, 14–18 \times 9–14 μ . Mucronate hyphopodia on separate hyphae in centre of colony, opposite, bent ampulliform, 13–18 \times 6–8 μ , neck upturned, short, 3–4 μ thick. Mycelial setae none. Perithecia loosely

scattered, black, globose, verrucose, up to 160μ diam., with 2-12 erect-spreading setae arising from upper half; setae more or less straight, simple, obtuse to subacute, 3-4-septate, up to 180μ long, 7-8 μ thick at base, gradually attenuate towards apex. Spores dark brown, cylindric, obtuse, 4-septate, constricted, $32-39 \times 13-15\mu$.

Family ICACINACEAE.

(16) MELIOLA CITRONELLAE Hansf., n. sp. (3111.5332). (Fig. 11.)

Plagulae amphigenae, densae, velutinae, usque ad 3 mm. diam. Mycelium ex hyphis atrobrunneis, undulatis, 7-8 μ crassis (cellulis plerumque 20-35 μ longis), opposite acuteque ramosis, dense reticulatis compositum, in centro plagularum subsolidum. Hyphopodia capitata alternata, antrorsa, recta vel curvata, 30-40 μ longa, cellula basali cuneata vel cylindracea, 6-15 μ longa, cellula apicali cylindracea vel clavata, apice rotundata, integra, saepe curvula, 20-31 \times 10-14 μ . Hyphopodia mucronata pauca, illis capitatis commixta, alternata vel opposita, ampullacea, curvata, 20-30 \times 6-9 μ , collo suberecto 3-4 μ crasso praedita. Setae myceliales numerosae, erectae, rectae, simplices, acutae, usque ad 350 \times 9-11 μ . Perithecia dispersa, atra, globosa, verrucosa, usque ad 250 μ diam. Sporae atrobrunneae, cylindraceae vel subellipsoideae, obtusae, 4-septatae, constrictae, 45-53 \times 19-23 μ , cellula media saepe leniter longiore et crassiore.

Hab. in foliis *Citronellae moorei*, Williams R., N.S.W., Fraser 66 (typus in Herb. Dept. Agric., Sydney); *loc. cit.*, Fraser 201.

Colonies amphigenous, dense, velvety, to 3 mm. diam., usually distinct. Mycelium of undulate dark brown hyphae 7-8 μ thick, the cells mostly 20-35 μ long, branching usually opposite at acute angles, closely reticulate and becoming almost solid in the centre of older colonies. Capitulate hyphopodia alternate, antrorse, straight or bent, 30-40 μ long; stalk cell cuneate to cylindric, 6-15 μ long; head cell cylindric to clavate, rounded at apex, entire, often bent, 20-31 \times 10-14 μ . Mucronate hyphopodia few, scattered amongst capitulate, alternate or opposite, bent ampulliform, 20-30 \times 6-9 μ , neck 3-4 μ thick, upturned. Mycelial setae numerous, erect, straight, simple, acute, up to 350 \times 9-11 μ . Perithecia scattered, black, globose, verrucose, up to 250 μ diam. Spores dark brown, cylindric, obtuse, 4-septate, constricted, 45-53 \times 19-23 μ , the centre cell often slightly longer and wider than the others.

Family LABIATAE.

(17) MELIOLA PROSTANTHERAE Hansf., n. sp. (3111.4221). (Fig. 12.)

Plagulae epiphyllae, numerosae et late confluentes, usque ad 1 mm. diam., subtenuae. Mycelium ex hyphis atrobrunneis, undulatis vel flexuosis, 6 μ crassis (cellulis plerumque 20-30 μ longis), opposite acuteque ramosis, laxe reticulatis compositum. Hyphopodia capitata alternata, recta vel curvata 16-23 μ longa, cellula basali cylindracea vel cuneata, 3-6 μ longa, cellula apicali subglobosa vel late ovata, integra, 11-15 \times 8-11 μ . Hyphopodia mucronata praecipue in hyphis distinctis evoluta, opposita vel alternata, ampullacea, curvata, 15-20 \times 7-9 μ , collo suberecto, 3 μ crasso praedita. Setae myceliales laxae dispersae, simplices, obtusae, rectae, usque ad 220 \times 6-7 μ , saepe apice leniter clavatae. Perithecia laxae dispersa, atra, globosa, verrucosa, usque ad 140 μ diam. Sporae atrobrunneae, cylindraceae, obtusae, 4-septatae, constrictae, 31-40 \times 13-15 μ .

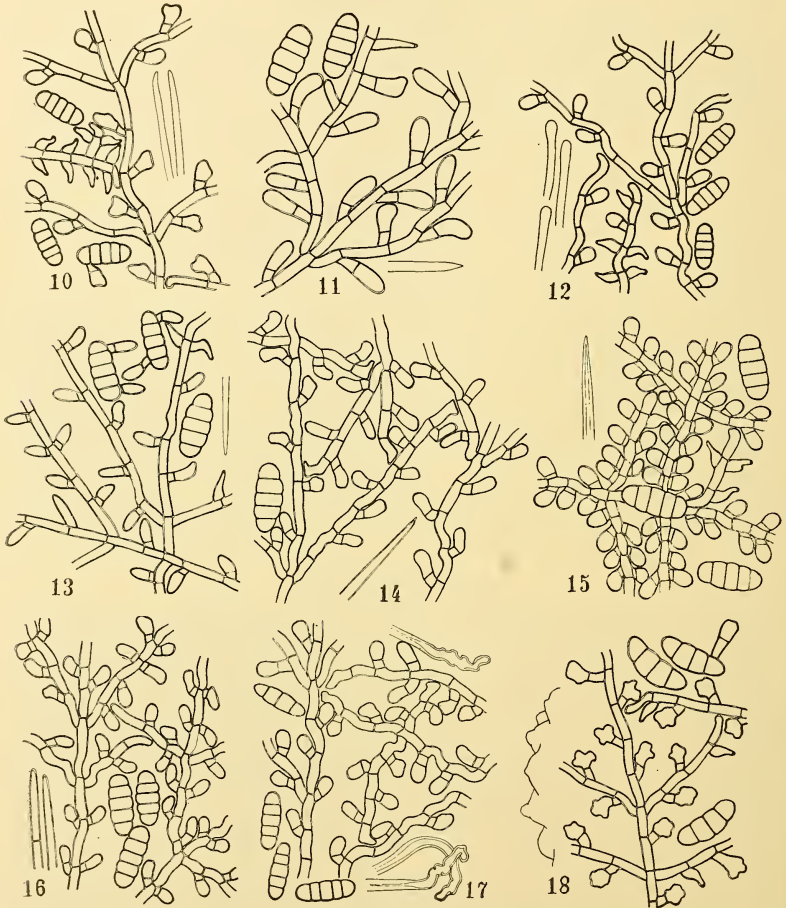
Hab. in foliis *Prostantherae sieberi*, National Park, N.S.W., Fraser 28 (typus in Herb. Dept. Agric., Sydney).

Colonies epiphyllous, numerous and confluent over leaf, up to 1 mm. diam., rather thin. Mycelium of crooked dark brown hyphae 6 μ thick, the cells mostly 20-30 μ long, branching usually opposite at acute angles, loosely reticulate. Capitulate hyphopodia alternate, at varying angles, straight or bent, 16-23 μ long; stalk cell cylindric or cuneate, 3-7 μ long; head cell subglobose to wide ovate, entire, 11-15 \times 8-11 μ . Mucronate hyphopodia mostly on separate hyphae, opposite or alternate, bent ampulliform, 15-20 \times 7-9 μ , neck upturned, 3 μ thick. Mycelial setae thinly scattered, simple, obtuse to often slightly clavulate, straight, up to 220 \times 6-7 μ . Perithecia loosely scattered, black, globose, verrucose, up to 140 μ diam. Spores dark brown, cylindric, obtuse, 4-septate, constricted, 31-40 \times 13-15 μ .

Family LAURACEAE.

(18) *ARMATELLA LITSEAE* (P. Henn.) Theiss & Syd., in *Ann. Myc., Berl.*, 13: 255, 1915.

Colonies amphigenous, thin, up to 10 mm. diam. or confluent, smooth. Mycelium of substraight to somewhat undulate dark brown hyphae $5-7\mu$ thick, the cells $15-30\mu$ long, branching alternate or irregular, loosely reticulate. Capitulate hyphopodia alternate, at



Text-figures 10-18. ($\times 250$.)

10, *Irenopsis fieldiae*. 11, *Meliola citronellae*. 12, *M. prostantherae*. 13, *M. dactylopoda* var. *brevipoda*. 14, *M. dysoxylicola*. 15, *M. dysoxyl.* 16, *M. brisbanensis*. 17, *Irenopsis berggrenii*. 18, *Irenina daphnandrae*.

wide angles, $15-22\mu$ long; stalk cell cylindrical $2-8\mu$ long; head cell ovate to subglobose with numerous rounded shallow lobes, $8-15 \times 10-15\mu$. No mucronate hyphopodia, nor mycelial setae. Perithecia loosely scattered, black, globose, up to 180μ diam., the surface cells bluntly conoid; the perithecia are easily secedent, leaving an areole of radiating hyphae without hyphopodia around their sites. Spores oblong with rounded

ends, 1-septate, slightly constricted, smooth, $34-42 \times 12-15\mu$; at germination the upper cell becomes much darker than the lower and forms a hyphopodium at its apex, while the lower cell collapses.

On *Cinnamomum virens*, Comboyne, N.S.W., Fraser 184; on *Cinnamomum* sp., Russell R., North Qld., Mueller, 1892, in National Herb., Victoria.

(19) IRENE KIRAIENSIS Yamamoto in *Trans. Nat. Hist. Soc., Formosa*, 31: 47, 1941. (2201.5230).

Colonies hypophyllous, dense, smooth, up to 1 mm. diam. Mycelium of substraight to slightly undulate dark brown hyphae $6-8\mu$ thick, the cells mostly $20-30\mu$ long, branching opposite or irregular at wide angles, closely reticulate. Capitulate hyphopodia alternate, more or less antrorse, straight or bent, $22-40\mu$ long; stalk cell cylindric, $5-19\mu$ long; head cell irregularly rounded-lobed, $16-22 \times 14-22\mu$. Mucronate hyphopodia few, mixed with capitate, alternate, bent ampulliform, $15-22 \times 8-10\mu$, the neck 3μ thick, upturned. Setae none. Perithecia in central group, black, globose, immature; many cells prolonged into larviform appendages, spreading-erect, incurved at the tips, simple, obtuse, continuous, translucent brown, transversely striate, up to 80μ long and 30μ diam. at the base, tapering to 15μ at the apex. Spores dark brown, bent ellipsoid, 3-septate, slightly constricted, $47-54 \times 17-19\mu$.

On *Cinnamomum virens*, Comboyne, N.S.W., Fraser 184.

This differs in some respects, notably in the dense colonies, from the original description, and further collections may make it necessary to erect a new species for the Australian fungus.

(20) IRENINA FRASERIANA (Syd.) Hansf., n. comb. (3101.4230).
= *Meliola fraseriana* Syd. in *Ann. Mycol., Berl.*, 35: 27, 1937.

Colonies hypophyllous, up to 4 mm. diam., or confluent, dense. Mycelium of dark brown, substraight to undulate hyphae $8-10\mu$ thick, the cells mostly $20-30\mu$ long, branching opposite at wide angles, closely reticulate. Capitulate hyphopodia alternate, more or less antrorse, straight or bent, often slightly recurved, $25-35\mu$ long; stalk cell cylindric, $4-10\mu$ long; head cell ovate to cylindric, rounded at apex, entire, $17-25 \times 10-14\mu$. Mucronate hyphopodia mixed with capitate, opposite or alternate, bent ampulliform, $18-23 \times 9-11\mu$, neck upturned, $3-4\mu$ thick. Mycelial setae none. Perithecia scattered, each on radiate subiculum, black, globose, verrucose, up to 350μ diam., the surface cells bluntly conoid, projecting up to 15μ . Spores dark brown, ellipsoid, obtuse, 4-septate, constricted, $42-48 \times 18-20\mu$.

On *Cryptocarya meissneri*, N.S.W., Fraser (type); on *C. glaucescens*, Williams R., N.S.W., Fraser 208; Comboyne, Fraser 200; Clyde Mountain, Fraser 153.

(21) MELIOLA DACTYLOPODA Syd., var. BREVIPODA Hansf., n. var. (3113.4223). (Fig. 13.)

Plagulae amphigenae, tenues, usque ad 5 mm. diam., vel in hypophyllo effusae confluentesque. Mycelium ex hyphis atrobrunneis, subrectis vel leniter undulatis, $6-7\mu$ crassis (cellulis plerumque $20-30\mu$ longis), opposita acuteque ramosis, laxe reticulatis compositum. Hyphopodia capitata alternata vel circa 2% opposita, plus minusve antrorsa, recta vel curvula, $16-27\mu$ longa, cellula basali cylindracea, $3-9\mu$ longa, cellula apicali saepius ovata, apice obtuse attenuata, vel interdum cylindraceae et apice obtusa, $13-20 \times 7-10\mu$. Hyphopodia mucronata illis capitatis commixta, alternata vel opposita, ampullacea, curvata, $14-23 \times 6-8\mu$, collo elongato, suberecto, 3μ crasso praedita. Setae myceliales laxe dispersae, etiam juxta perithecia aggregatae, erectae, plus minusve rectae, simplices, acutae, usque ad $900 \times 8-9\mu$. Perithecia laxe dispersa, atra, globosa, verrucosa, usque ad 190μ diam. Sporae atrobrunneae, cylindraceae vel subellipsoideae, obtusae, 4-septatae, constrictae, $38-46 \times 15-20\mu$.

Hab. in foliis *Cryptocaryae patentinervis*, Williams R., N.S.W., Fraser s.n., April, 1952 (typus in Herb. Dept. Agric., Sydney).

Colonies amphigenous, thin, to 5 mm. diam. or, especially on the lower surface of the leaf, effuse and confluent. Mycelium of substraight to somewhat undulate dark brown hyphae $6-7\mu$ thick, the cells mostly $20-30\mu$ long, branching opposite at acute

angles, loosely reticulate. Capitata hyphopodia alternate or about 2% opposite, more or less antrorse, straight, or slightly bent, 16-27 μ long (considerably shorter than in the type from S. Africa); stalk cell cylindric, 3-9 μ long; head cell mostly ovate with somewhat pointed apex, sometimes bent cylindric with bluntly rounded apex, 13-20 \times 1-10 μ . Mucronate hyphopodia mixed with capitata, alternate or opposite, bent ampulliform, 14-23 \times 6-8 μ , neck rather long, upturned, 3 μ thick. Mycelial setae thinly scattered and shorter ones grouped around the perithecia, erect, more or less straight, simple, acute, up to 900 \times 8-9 μ . Perithecia loosely scattered, black, globose, verrucose, up to 190 μ diam. Spores dark brown, cylindric-ellipsoid, obtuse, 4-septate, constricted, 38-46 \times 15-20 μ .

(22) *MELIOLA PRAETERVISA* Gaill., Le Genre *Meliola*, 1892, p. 78 (3112.5333).

Colonies mostly epiphyllous, up to 2 mm. diam. or numerous and sometimes confluent, dense, somewhat velvety. Mycelium of straight dark brown hyphae 8-9 μ thick, the cells mostly 15-20 μ long, branching opposite at wide angles, densely reticulate and almost solid in the centre. Capitata hyphopodia opposite save where crowded, more or less antrorse, straight or slightly bent, 16-22 μ long; stalk cell cylindric, 5-6 μ long; head cell piriform to cylindric with rounded apex, entire, 11-17 \times 8-11 μ . Mucronate hyphopodia rather few, mixed with capitata, opposite or alternate, bent ampulliform, 15-23 \times 7-9 μ , neck upturned, 4-5 μ thick. Mycelial setae few to fairly numerous, scattered and also grouped around perithecia, erect, straight, simple, obtuse, up to 450 \times 12-14 μ . Perithecia in loose central group, black, globose, verrucose, up to 240 μ diam. Spores dark brown, cylindric to subellipsoid, obtuse, 4-septate, constricted, 50-59 \times 23-28 μ .

On *Endiandra sieberi*, Woodburn, N.S.W., Fraser 233; on undetermined Lauraceae, Hastings R., N.S.W., Fraser s.n., April, 1952. (The latter specimen has setae up to 650 μ long.)

Family MELIACEAE.

(23) *MELIOLA DYSOXYLICOLA* Hansf., n. sp. (3113.4224). (Fig. 14.)

Plagulae hypophyllae, atrae, usque ad 1.5 mm. diam., subtenues. Mycelium ex hyphis atrobrunneis, leniter undulatis, 6-8 μ crassis (cellulis plerumque 25-30 μ longis), opposita ramosis (30-60°), laxe reticulatis compositum, in centro plagularum, subsolidum. Hyphopodia capitata alternata, vel circa 1% opposita, plus minusve curvata, 15-25 μ longa, cellula basali cylindracea, 5-8 μ longa, cellula apicali cylindraceo-clavulata, saepe curvula, integra vel lenissime angulosa, 10-19 \times 7-11 μ . Hyphopodia mucronata illis capitatis commixta, opposita vel alternata, pauca, ampullacea, curvata. Setae myceliales dispersae, erectae, recte, simplices, acutae, usque ad 1100 \times 8-9 μ . Perithecia non visa. Sporae ellipsoideae, atrobrunneae, 4-septatae, constrictae, 42-46 \times 17-19 μ .

Hab. in foliis *Dysoxylis* spec. indet., Murwillumbah, N.S.W., July, 1896, Baker (typus in Herb. Dept. Agric., Melbourne).

Colonies hypophyllous, black, orbicular, up to 1.5 mm. diam., rather thin. Mycelium of slightly undulate, dark brown hyphae 6-8 μ thick, the cells mostly 25-30 μ long, branching usually opposite at acute angles, forming a loose network, becoming dense in centre of colony. Capitata hyphopodia alternate or about 1% opposite, more or less bent, 15-25 μ long; head cell cylindric-clavate, often bent, entire or slightly angulose, 10-19 \times 7-11 μ ; stalk cell cylindric-cuneate, 5-8 μ long. Mucronate hyphopodia mostly on separate hyphae but mixed with a few capitata, opposite or alternate, few, ampulliform with bent neck. Mycelial setae scattered, erect, straight, simple, acute, up to 1100 \times 8-9 μ . Mature perithecia not seen. Spores dark brown, cylindric to ellipsoid, 4-septate, obtuse, constricted, 42-46 \times 17-19 μ .

(24) *MELIOLA DYSOXYLI* Hansf., n. sp. (3112.4221). (Fig. 15.)

Plagulae epiphyllae, usque ad 1 mm. diam., vel confluentes, densae. Mycelium ex hyphis subrectis, atrobrunneis, 7 μ crassis (cellulis plerumque circa 15 μ longis), opposita lateque ramosis, densissime reticulatis compositum, subsolidum. Hyphopodia capitata opposita, plus minusve antrorsa, 14-20 μ longa, cellula basali cylindracea, 2-5 μ longa,

cellula apicali globosa vel late ovata, integra, 11–16 × 9–12 μ . Hyphopodia mucronata illis capitatis commixta, opposita vel alternata, ampullacea, curvata, 15–20 × 7–10 μ , collo suberecto 3 μ crasso praedita. Setae myceliales erectae, rectae, simplices, acutae, usque ad 450 × 10–11 μ . Perithecia in centro plagularum aggregata, atra, globosa, verrucosa, usque ad 180 μ diam. Sporae atrobrunneae, ellipsoideae, obtusae, 4-septatae, constrictae, 42–48 × 17–19 μ .

Hab. in foliis *Dysoxyl*i, spec. indet., Peradeniya, Ceylon, Thwaites (typus in Herb. Kew); in petiolibus *Dysoxyl*i *fraseriani*, Allyn R., N.S.W., Fraser 218.

The Australian collection corresponds closely to the type from Ceylon: Colonies on petioles only, up to 2 mm. long, or sometimes confluent, dense. Mycelium of substraight dark brown hyphae 7 μ thick, the cells mostly about 15 μ long, branching opposite at wide angles, very densely reticulate and almost solid. Capitulate hyphopodia opposite or alternate, more or less antrorse, 14–20 μ long; stalk cell cylindrical, 2–5 μ long; head cell globose to wide ovate, entire, 11–16 × 9–12 μ . Mucronate hyphopodia mixed with capitulate, opposite or alternate, bent ampulliform, 15–20 × 7–10 μ , neck upturned, 3 μ thick. Mycelial setae erect, straight, simple, acute, up to 450 × 10–11 μ . Perithecia in central group, black, globose, verrucose, up to 180 μ diam. Spores dark brown, ellipsoid, obtuse, 4-septate, constricted, 42–48 × 17–19 μ .

(25) MELIOLA MACALPINI Sacc. & Syd. in *Sacc. Syll. Fung.*, 14: 471, 1899.

= *Meliola denticulata* McAlp. in *Proc. Linn. Soc. N.S.W.*, 1897, p. 700 (non Winter) (3133.4221).

The type collection on *Dysoxylum* sp., Byangum, N.S.W., Baker, July, 1896, from the Herbarium of Dept. Agric., Melbourne, has been examined.

Colonies epiphyllous, about 0.5 mm. diam., black, scattered, velvety, dense. Mycelium of substraight dark brown hyphae 7–8 μ thick, branching usually opposite at wide angles, the cells mostly 14–20 μ long, closely reticulate. Capitulate hyphopodia alternate or opposite, more or less antrorse, straight or bent, 16–20 μ long; head cell ovate to cylindrical with rounded apex, 11–15 × 7–10 μ ; stalk cell cylindrical, 5–8 μ long. Mucronate hyphopodia mixed with capitulate, few, opposite or alternate, conoid to ampulliform with short upturned neck. Mycelial setae thickly scattered, erect, straight, slightly thickened and usually 3-dentate to 10 μ at apex, up to 280 × 9–11 μ . Perithecia black, globose, verrucose, immature. Spores dark brown, cylindrical, obtuse, 4-septate, constricted, 47 × 18 μ (few seen).

Apparently this species has not yet been re-discovered, as no other Australian collection I have seen corresponds with it, particularly in the dentate setae.

Family MIMOSACEAE.

(26) MELIOLA BRISBANENSIS Hansf., n. sp. (3113.4223). (Fig. 16.)

Plagulae amphigenae, tenues vel densae, usque ad 2 mm. diam., vel confluentes. Mycelium ex hyphis atrobrunneis, subrectis vel flexuosis, 6–7 μ crassis (cellulis plerumque 20–30 μ longis), opposita ramosis, laxe vel dense reticulatis compositum. Hyphopodia capitata opposita vel alternata, recta vel curvula, 13–20 μ longa, cellula basali cylindracea, 3–7 μ longa, cellula apicali ovata, apice rotundata, integra, 9–16 × 7–10 μ . Hyphopodia mucronata illis capitatis commixta, alternata vel opposita, ampullacea, 15–20 × 6–8 μ , collo suberecto, 3 μ crasso praedita. Setae myceliales dispersae, etiam juxta perithecia aggregatae, erectae, rectae, simplices, obtusae, usque ad 530 × 7–9 μ (in typus 250 μ longae). Perithecia dispersa vel laxe gregaria, atra, globosa, verrucosa, usque ad 190 μ diam. Sporae atrobrunneae, cylindraceae vel subellipsoideae, obtusae, 4-septatae, constrictae, 38–51 × 15–18 μ .

Hab. in foliis *Acaciae cunninghamii*, Brisbane, Qld., Bailey 184 (typus in Herb. Queensland, Brisbane); Sunnybank, Qld., C. T. White 4; in foliis *Acaciae binervatae*, National Park, N.S.W., Fraser 171, 25, 79; in foliis *Acaciae*, spec. indet., Woodburn, N.S.W., Fraser 234.

Colonies amphigenous, thin to dense, up to 2 mm. diam. or confluent and larger, black. Mycelium of substraight to irregularly flexuous dark brown hyphae 6–7 μ thick,

the cells mostly 20–30 μ long, branching usually opposite at variable angles, becoming closely reticulate towards the centre of older colonies. Capitata hyphopodia opposite or alternate, in thinner parts of colonies mostly opposite, more or less bent, 13–20 μ long; head cell ovate to somewhat irregularly rounded-angulose, often bent, 9–16 \times 7–10 μ ; stalk cell cylindrical, 3–7 μ long. Mycelial setae thinly scattered, erect, straight, simple, obtuse, up to 250 \times 6–8 μ in the type to 530 μ in other specimens quoted. Perithecia scattered, black, depressed globose, verrucose, immature in type, up to 190 μ diam. in other specimens. Spores dark brown, cylindrical with obtuse ends, 4-septate, constricted, 38–45 \times 15–17 μ in type specimen, up to 51 \times 18 μ in other specimens. No other differences were found between the type and the other specimens, so that the ranges of measurements given in the diagnosis have been extended to include these. A further specimen is on *A. harpophylla*, Rosewood, Qld., C. T. White, 1911.

(27) *IRENOPSIS BERGGRENII* Hansf. in *Proc. Linn. Soc. London* (in press) (3403.4230). (Fig. 17.)

Colonies hypophyllous, scattered, black, circular, 1–3 mm. diam., dense, smooth. Mycelium of dark brown, substraight to somewhat sinuous hyphae, 8–9 μ thick, the cells mostly 15–25 μ long, branching usually opposite at wide angles, closely reticulate. Capitata hyphopodia alternate or about 1% opposite, straight or bent, 14–30 μ long; stalk cell cylindrical, straight or bent, 4–16 μ long; head cell from wide ovate to piriform or cylindrical-clavulate, often irregularly bent, entire, rounded angulose or shallowly lobate, 10–18 \times 8–12 μ . Mucronate hyphopodia on few separate hyphae in centre of colony, opposite or alternate, ampulliform, more or less bent, 15–20 \times 7–10 μ , neck sub-erect, bent, 3–4 μ thick, rather short. Mycelial setae none. Perithecia closely scattered, black, globose, slightly verrucose, up to 250 μ diam., the surface cells rounded-convex; each with 20–30 erect-spreading setae arising from upper half; setae pale brown, thick-walled in lower part, thinner above, indistinctly 1–2-septate, apex simple, obtuse, variously twisted or contorted, smooth, up to 100 \times 7–10 μ . Spores dark brown, cylindrical, obtuse, 4-septate, 38–45 \times 12–15 μ ; in the original diagnosis the spores were given as 3-septate, but these are abnormal, as shown by collections examined since, which contain even a few obviously abnormal 2-septate spores.

On *Acacia melanoxylon*, Melbourne, Vict., Berggren 381 (typus in Herb. Stockholm, also represented at Herb. Kew); on *Acacia linifolia*, National Park, N.S.W., Fraser 10A; on *A. penninervis*, Clyde Mountain, N.S.W., Fraser 168; on *A. maidenii*, Williams R., N.S.W., Fraser 102; on *A. mabellae*, Myrtle Gully, N.S.W., Fraser 158.

Family MONIMIACEAE.

(28) *IRENE KIRAIENSIS* Yamamoto.

I find no difference between the following specimens and that on *Cinnamomum*, described under No. 19 above:

On *Doryphora sassafras*, National Park, N.S.W., Fraser 26; Clyde Mountain, N.S.W., Fraser 178; on *Atherosperma moschatum*, Kallista, Vict., Fraser 193.

(29) *IRENINA DAPHNANDRAE* Hansf., n. sp. (2101.5240). (Fig. 18.)

Plagulae amphigenae, usque ad 2 mm. diam., tenues vel subdensae, saepe numerosae confluentesque, leves. Mycelium ex hyphis atrobrunneis, leniter undulatis, 7 μ crassis (cellulis plerumque 20–25 μ longis), opposita lateque ramosis, subdense reticulatis compositum. Hyphopodia capitata alternata, plus minusve antrorsa, recta vel curvata, 18–28 μ longa, cellula basali cylindracea, 5–12 μ longa, cellula apicali irregulariter lobata, 12–17 \times 11–16 μ . Hyphopodia mucronata illis capitatis commixta, alternata, ampullacea, curvata, 15–20 \times 7–9 μ , collo erecto, 3 μ crasso praedita. Setae myceliales nullae. Perithecia dispersa vel laxae aggregata, atra, globosa, verrucosa, usque ad 330 μ diam., cellulis parietis obtuse conoideis vel mammillatibus, usque ad 20 μ alt. Sporae atrobrunneae, curvato-ellipsoideae, 3-septatae, constrictae, 44–52 \times 16–19 μ .

Hab. in foliis *Daphnandrae micranthae*, Williams R., N.S.W., Fraser 132 (typus in Herb. Dept. Agric., Sydney), 297.

Colonies amphigenous, to 2 mm. diam., thin to rather dense, often numerous and confluent, smooth. Mycelium of slightly undulate dark brown hyphae 7μ thick, the cells mostly 20–25 μ long, branching opposite at wide angles, rather closely reticulate. Capitulate hyphopodia alternate, more or less antrorse, straight or bent, 18–28 μ long; stalk cell cylindrical, 5–12 μ long; head cell irregularly lobed, 12–17 \times 11–16 μ . Mucronate hyphopodia mixed with capitulate, alternate, bent ampulliform, 15–20 \times 7–9 μ , neck erect, 3 μ thick. Perithecia scattered or in a loose central group, black, globose, verrucose, up to 330 μ diam., the surface cells bluntly conoid to mammillate, projecting up to 20 μ . Spores dark brown, bent ellipsoid, ends obtuse, 3-septate, constricted, 44–52 \times 16–19 μ .

The hyphopodia and spores are very close to those of *Irene kiraiensis*, but the general character of the colonies and mycelium is distinct, and the perithecia do not bear larviform appendages even when fully mature.

(30) *IRENINA HEDYCARYAE* Hansf., n. sp. (3101.5330). (Fig. 19.)

Plagulae amphigenae, plerumque epiphyllae, atrae, densae, subcrustosae, leves, usque ad 3 mm. diam., numerosae et interdum confluentes. Mycelium ex hyphis atrobrunneis, subrectis, 7–10 μ crassis (cellulis plerumque circa 30 μ longis), opposita acutepae ramosis, dense reticulatis compositum. Hyphopodia capitata alternata, antrorsa, 30–37 μ longa, cellula basali cylindracea, 5–11 μ longa, cellula apicali clavulato-cylindracea, apice late rotundata, saepe lenissime curvata, 22–28 \times 11–18 μ . Hyphopodia mucronata pauca, illis capitatis commixta, opposita vel alternata, ampullacea, curvata, 18–28 \times 8–11 μ , collo suberecto 3–5 μ crasso praedita. Setae myceliales nullae. Perithecia laxa aggregata, atra, globosa, verrucosa, usque ad 320 μ diam., cellulis parietis rotundatis, vix prominentibus. Sporae atrobrunneae, cylindraceae vel subellipsoideae, obtusae, 4-septatae, constrictae, 54–59 \times 21–24 μ .

Hab. in foliis *Hedycaryae*, spec. indet., Fern Gully, Kallista, Vict. (typus in Herb. Melbourne University).

Colonies amphigenous, mostly epiphyllous, black, dense, subcrustose, smooth, up to 3 mm. diam., numerous and sometimes confluent, with a central loose group of perithecia. Mycelium of dark brown substraight hyphae 7–10 μ thick, the cells mostly about 30 μ long, branching usually opposite at acute angles. Capitulate hyphopodia alternate, more or less antrorse, 30–37 μ long; head cell cylindrical-clavulate, widely rounded at apex, often slightly bent, 22–28 \times 11–18 μ ; stalk cell cylindrical, 5–11 μ long. Mucronate hyphopodia few, often scattered around the edge of the colony, opposite or unilateral, ampulliform with short bent neck, 18–28 \times 8–11 μ . Setae none. Perithecia each on a solid disc of radiating exhyphopodiate hyphae up to 180 μ long, paler than the rest of the mycelium; black, flattened globose, up to 320 μ diam. and about 200 μ high, verrucose, the surface cells rounded and scarcely projecting from the general surface. Spores dark brown, bent cylindrical with rounded ends, 4-septate, constricted, 54–59 \times 21–24 μ .

Family MORACEAE.

(31) *MELIOLA PSEUDOMORI* Hansf., n. sp. (3411.52x2). (Fig. 20.)

Plagulae hypophyllae, tenues, usque ad 2 mm. diam. Mycelium ex hyphis atrobrunneis, undulatis vel flexuosis, 7–8 μ crassis (cellulis plerumque 25–40 μ longis), alternatim vel irregulariter ramosis, laxe reticulatis compositum. Hyphopodia capitata alternata, plerumque irregulariter curvata, 30–60 μ longa, cellula basali cylindracea, 12–35 μ longa; cellula apicali irregulariter profundeque lobata, versiformia, 18–30 \times 15–25 μ . Hyphopodia mucronata praecipue in hyphis distinctis evoluta, opposita vel alternata, ampullacea, curvata, 18–22 \times 7–9 μ , collo suberecto, 3–4 μ crasso praedita. Setae myceliales laxae dispersae, etiam juxta perithecia aggregatae, erectae, subrectae, simplices, obtusae, usque ad 350 \times 8–10 μ , sursum attenuatae. Perithecia laxae dispersae, atra, globosa, verrucosa, immatura; superne setis 0–4, erecto-patentibus, simplicibus. obtusis, continuis, apice curvatis, non uncinatis, usque ad 60 \times 8 μ , extus minute sparseque granulosis ornata. Sporae atrobrunneae, cylindraceae, obtusae, 4-septatae, 48–54 \times 17–18 μ .

Hab. in foliis *Pseudomori pendulinae* var. *australianae*, Brushy Mountain, N.S.W., Sept., 1897, J. H. Maiden.

Colonies hypophyllous, thin, to 2 mm. diam. Mycelium of undulate to crooked dark brown hyphae 7–8 μ thick, the cells mostly 25–40 μ long, branching alternate or irregular, not opposite, loosely reticulate. Capitate hyphopodia alternate or more scattered, usually irregularly bent, 30–60 μ long; stalk cell cylindrical, 12–35 μ long, often bent; head cell very irregularly and deeply lobed, versiform, 18–30 \times 15–25 μ . Mucronate hyphopodia mostly on separate hyphae, opposite or alternate, bent ampulliform, 18–22 \times 7–9 μ , neck upturned, 3–4 μ thick. Mycelial setae thinly scattered and around the perithecia, erect, more or less straight, simple, obtuse, up to 350 \times 8–10 μ , gradually attenuate upwards. Perithecia loosely scattered, black, globose, verrucose, immature; on upper half each with 0–4 spreading-erect setae, simple, obtuse, continuous, up to 60 \times 8 μ , apex sometimes bent but not uncinatate, surface minutely and sparsely granulose. Spores dark brown, cylindrical, obtuse, 4-septate, 48–54 \times 17–18 μ .

Family MYRTACEAE.

(32) MELIOLA QUEENSLANDICA (E. Fisher) Hansf., n. comb.

= *Meliola polytricha* K. & C., var. *queenslandica* E. Fisher in *Proc. Roy. Soc. Vict.*, 62: 134, 1950 (3113.6333).

Colonies amphigenous, rather dense, thinly velvety, 1–2 mm. diam. Mycelium of dark brown, substraight to undulate or even flexuous hyphae 7–9 μ thick, the cells mostly 15–25 μ long, branching usually opposite at acute angles, closely reticulate. Capitate hyphopodia opposite or alternate, more or less antrorse, often bent, 23–42 μ long; stalk cell cylindrical, 5–12 μ long; head cell elongate, irregularly sinuous-bent, versiform, variously lobed or almost entire, 18–30 \times 11–18 μ . Mucronate hyphopodia mixed with capitate, opposite or alternate, ampulliform with upturned rather short neck. Mycelial setae variable in number, scattered, erect, straight, simple, obtuse or acute, up to 640 \times 8–11 μ , in some specimens not exceeding 400 μ long. Perithecia scattered, black, globose, verrucose, up to 250 μ diam. Spores dark brown, cylindrical to ellipsoid with obtuse ends, 4-septate, slightly constricted, 55–65 \times 16–22 μ .

On *Callistemon viminalis*, Gold Creek, Brisbane, Qld., Fisher (type); Goodna, Qld., C. T. White 5; Gladstone, Qld., Tryon; Woodenbong, N.S.W., Fraser 235; on *C. salignus*, Hunter R., N.S.W., R. Brown 570 (in Herb. Kew); Williams R., N.S.W., Fraser 50, 106; on *C. spp. indet.*, North Queensland (in Herb. Stockholm, collector unknown); Brisbane, Qld., Bailey 633.

In the original diagnosis "conidia" were included, which probably belonged to *Helminthosporium capense* Thuem., a common parasite of *Meliola* spp. in Australia and elsewhere. No true conidial stage is known for any species of this genus.

(33) MELIOLA DENSA Cooke in *Grevillea*, 12: 85, 1884 (3121.4221).

Colonies hypophyllous, black, dense, somewhat velvety, 1–3 mm. diam. or confluent and larger. Mycelium of crooked dark brown hyphae 7–8 μ thick, the cells mostly 20–25 μ long, branching irregular, closely reticulate, the meshes enclosing the stomata of the host leaf. Capitate hyphopodia alternate, rarely also opposite, variously bent, mostly 15–25 μ long; stalk cell cylindrical or irregularly bent, 5–14 μ long; head cell from ovate and entire to cylindrical-clavate or variously bent and angulose, sometimes broadly truncate at apex, 12–20 \times 7–10 μ . Mycelial setae numerous in some colonies, erect, simple, obtuse, broadly arcuate to uncinatate above, but in other colonies almost straight and varying to acute, up to 280 \times 8–10 μ . Perithecia scattered, black, globose, verrucose, up to 180 μ diam. Spores dark brown, cylindrical with rounded ends to somewhat ellipsoid, 4-septate, constricted, 43–48 \times 16–19 μ .

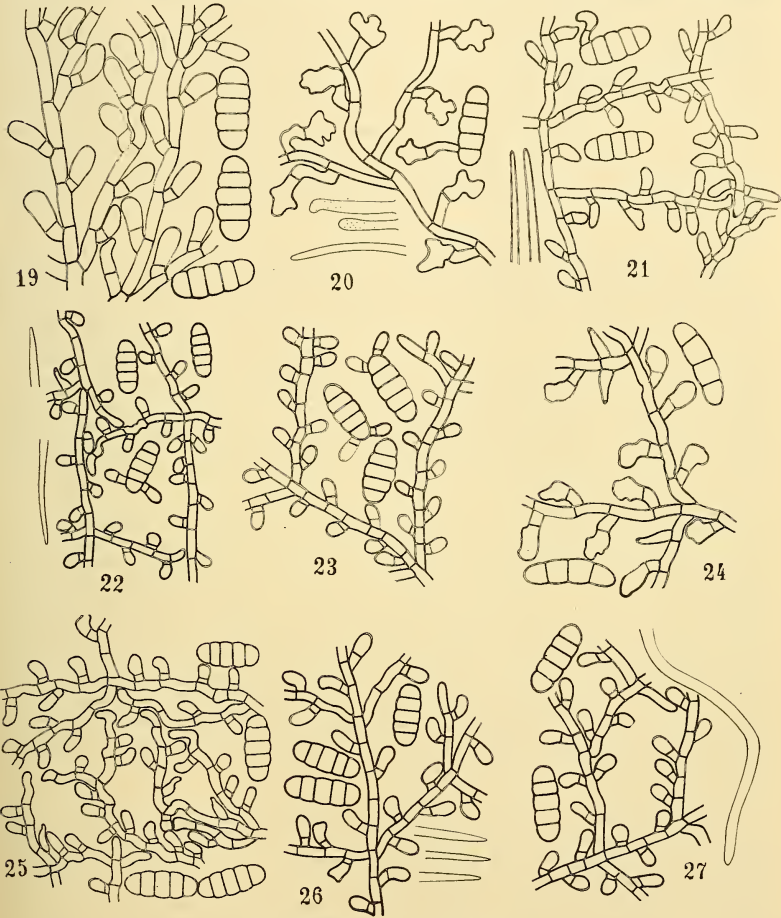
On *Eucalyptus* spp., Queensland.

The type was described from Herbert R., Queensland, and other specimens examined include Bailey 556, 587, also collected in Queensland. Outside Australia, what appears to be the same species occurs on *Eugenia* spp. in West Africa.

(34) MELIOLA EUGENIAE-JAMBOLOIDIS Hansf., var. AUSTRALIENSIS Hansf., n. var. (3113.5334). (Fig. 21.)

Plagulae hypophyllae, atrae, 1–2 mm. diam. vel in conflendo majores, tenues vel subdensae, interdum tenuiter velutinae. Mycelium ex hyphis atrobrunneis, flexuosis,

6-8 μ crassis (cellulis plerumque 20-30 μ longis), opposite vel irregulariter ramosis, laxe dein subdense reticulatis compositum. Hyphopodia capitata alternata vel usque ad 15% opposita, antrorsa, saepe irregulariter curvata, 20-30 μ longa, cellula basali cylindracea, 5-15 μ longa, cellula apicali cylindracea vel ovata, apice late rotundata, interdum



Text-figures 19-27. ($\times 250$.)

19, *Irenina hedycaryae*. 20, *Meliola pseudomori*. 21, *M. eugeniae-jamboloidis* var. *australiensis*. 22, *M. leptospermi*. 23, *Irenina acmenae*. 24, *I. eucalyptorum*. 25, *I. australiana*. 26, *Meliola notelaeae*. 27, *M. emmenospermatis*.

angulosa et curvata, 12-20 \times 6-12 μ . Hyphopodia mucronata alternata vel opposita, illis capitatis commixta, ampullacea, curvata, 20-25 \times 7-9 μ , collo suberecto, 3 μ crasso praedita. Setae myceliales dispersae, paucae vel numerosae, erectae, rectae, simplices, obtusae, usque ad 1100 \times 7-10 μ . Perithecia dispersa, atra, globosa, verrucosa, usque ad 220 μ diam. Sporae atrobrunneae, ellipsoideae, obtusae, 4-septatae, constrictae, 45-51 \times 18-21 μ .

Hab. in foliis *Tristaniae*, spec. indet., Queensland, Bailey 587 in Queensland Herb., Brisbane; in foliis *Tristaniae suaveolentis*, Urunga, N.S.W., Fraser 228; in foliis *Rhodomyrti psidioidis*, N.S.W., Williams R., Fraser 216; Grafton, Fraser 195.

Colonies hypophyllous, black, 1-2 mm. diam. or confluent and larger, thin to subdense, sometimes thinly velvety. Mycelium of rather flexuous dark brown hyphae 6-8 μ thick, the cells mostly 20-30 μ long, branching opposite or irregular at wide angles, forming first a loose network, becoming rather dense in centre of older colonies. Capitata hypophodia alternate or up to 15% opposite, antrorse, frequently irregularly bent, 20-32 μ long; stalk cell cylindrical, 5-15 μ long; head cell cylindrical to ovate, widely rounded at apex, often irregularly angulose and bent, 12-20 \times 6-12 μ . Mucronate hypophodia alternate or opposite, mixed with capitata, long ampulliform with bent neck. Mycelial setae scattered, few to fairly numerous, erect, straight, black, simple, obtuse, up to 1100 \times 7-10 μ thick at the base. Mature perithecia up to 220 μ diam., scattered, black, globose, verrucose. Spores dark brown, ellipsoid with rounded ends, 4-septate, constricted, 45-51 \times 18-21 μ .

(35) *MELIOLA LEPTOSPERMI* Hansf., n. sp. (3113.4231). (Fig. 22.)

Plagulae amphigenae, subdensae, usque ad 2 mm. diam. vel confluentes. Mycelium ex hyphis atrobrunneis, subrectis vel flexuosis, 6-7 μ crassis (cellulis plerumque 15-20 μ longis), opposita lateque ramosis, dense reticulatis compositum. Hypophodia capitata alternata vel usque ad 2% opposita, recta vel curvata, 10-16 μ longa, cellula basali cylindracea, 2-5 μ longa, cellula apicali subglobosa vel oblonga, apice late rotundata, integra, 7-12 \times 6-9 μ . Hypophodia mucronata illis capitatis commixta, alternata vel opposita, ampullacea, curvata, 15-20 \times 6-8 μ , collo subrecto, 3 μ crasso praedita. Setae myceliales paucissimae, praecipue juxta perithecia evolutae, erectae, plus minusve rectae, simplices, obtusae vel subacutae, usque ad 290 \times 7-8 μ . Perithecia laxe aggregata, atra, globosa, verrucosa, usque ad 215 μ diam. Sporae atrobrunneae, cylindraceae, obtusae, 4-septatae, constrictae, 36-43 \times 14-16 μ .

Hab. in foliis *Leptospermi brachyandri*, Orara R., N.S.W., Fraser 189 (typus in Herb. Dept. Agric., Sydney).

Colonies amphigenous, rather dense, up to 2 mm. diam. or confluent. Mycelium of substraight to crooked dark brown hyphae 6-7 μ thick, the cells mostly 15-20 μ long, branching opposite at wide angles, closely reticulate. Capitata hypophodia alternate or about 2% opposite, straight or bent, 10-16 μ long; stalk cell cylindrical, 2-5 μ long; head cell subglobose to oblong, widely rounded at apex, entire, 7-12 \times 6-9 μ . Mucronate hypophodia mixed with capitata, alternate or opposite, bent ampulliform, 15-20 \times 6-8 μ , neck upturned, 3 μ thick. Mycelial setae very few, mostly round the perithecia, erect, more or less straight, simple, obtuse to subacute, up to 290 \times 7-8 μ . Perithecia closely scattered, black, globose, verrucose, up to 215 μ diam. Spores dark brown, cylindrical, obtuse, 4-septate, constricted, 36-45 \times 14-16 μ .

(36) *IRENINA ACMENAE* Hansf., n. sp. (3103.5330). (Fig. 23.)

Plagulae epiphyllae, interdum etiam hypophyllae, leves, densae, usque ad 2 mm. diam. Mycelium ex hyphis atrobrunneis, subrectis vel sinuosis, 7-8 μ crassis (cellulis plerumque 12-20 μ longis), opposita acutaeque ramosis, dense reticulatis compositum. Hypophodia capitata alternata vel usque ad 1% opposita, plus minusve antrorsa, plerumque recta, 13-18 μ longa; cellula basali cylindracea, 2-5 μ longa, cellula apicali globosa vel oblonga, integra, 10-13 \times 8-10 μ . Hypophodia mucronata illis capitatis commixta, alternata vel opposita, ampullacea, curvata, 15-22 \times 7-9 μ , collo subrecto, 3-4 μ crasso praedita. Setae nullae. Perithecia laxe aggregata, atra, globosa, verrucosa, usque ad 220 μ diam., cellulis parietis obtuse conoideis, usque ad 20 μ alt. Sporae atrobrunneae, ellipsoideae, obtusae, 4-septatae, constrictae, 45-52 \times 20-23 μ .

Hab. in foliis *Acmenae smithii* var. *minoris*, Grafton, N.S.W., Fraser 199 (typus in Herb. Dept. Agric., Sydney); in foliis *Acmenae smithii*, National Park, N.S.W., Fraser 15; Myrtle Gully, N.S.W., Fraser 159; Wully, Williams R., N.S.W., Fraser 103; in foliis *Eugeniae ventenatii*, Grafton, N.S.W., Fraser 185.

Colonies epiphyllous, less commonly also hypophyllous, smooth, dense, to 2 mm. diam. Mycelium of substraight to sinuous dark brown hyphae 7–8 μ thick, the cells mostly 12–20 μ long, branching usually opposite at acute angles, closely reticulate. Capitate hyphopodia alternate or about 1% opposite, more or less antrorse, usually straight, 13–18 μ long; stalk cell cylindrical, 2–5 μ long; head cell globose to oblong, entire, 10–13 \times 8–10 μ . Mucronate hyphopodia mixed with capitate, alternate or opposite, bent ampulliform, 15–22 \times 7–9 μ , neck upturned, 3–4 μ thick. Setae none. Perithecia in loose central group, black, globose, verrucose up to 215 μ diam., surface cells bluntly conoid, projecting up to 20 μ . Spores dark brown, ellipsoid, obtuse, 4-septate, constricted, 43–52 \times 20–23 μ .

(37) *IRENINA EUCALYPTORUM* Hansf., n. sp. (2101.6340). (Fig. 24.)

Plagulae amphigenae, densae, usque ad 5 mm. diam., leves. Mycelium ex hyphis atrobrunneis, sinuosis vel flexuosis, 8–9 μ crassis (cellulis plerumque 20–30 μ longis), opposita vel irregulariter ramosis, dense reticulatis compositum. Hyphopodia capitata alternata, plus minusve curvata, 22–35 μ longa, cellula basali cylindracea, 7–15 μ longa, cellula apicali versiformia, ex rotundato-angulosa vel irregulariter lobata, saepe curvata, 15–25 \times 12–18 μ . Hyphopodia mucronata illis capitatis commixta, ampullacea, 17–25 \times 8–10 μ , collo suberecto, 3–4 μ crasso praedita. Setae nullae. Perithecia dispersa, atra, globosa, verrucosa, usque ad 330 μ diam., cellulis parietis concis, usque ad 25 μ alt. Sporae atrobrunneae, cylindraceae vel ellipsoideae, curvatae, obtusae, 3-septatae, leniter constrictae, 54–69 \times 17–20 μ .

Hab. in foliis *Eucalypti satignae*, Williams R., N.S.W., Fraser 84 (typus in Herb. Dept. Agric., Sydney); Narara, N.S.W., Fraser s.n., May, 1941; in foliis *E. trianthae*, Williams R., N.S.W., Fraser 85; in foliis *E. microcorydis*, Bulga, N.S.W., Fraser 49; in foliis *E. spec. indet.*, Bellbrook, N.S.W., Fraser 182 p.p.; Brisbane, Qld., Bailey s.n.; in foliis *Backhousiae myrtifoliae*, Blackheath, N.S.W., Fraser 217; Myrtle Gully, N.S.W., Fraser 167.

Colonies amphigenous, dense, up to 5 mm. diam., smooth. Mycelium of sinuous to crooked dark brown hyphae 8–9 μ thick, the cells mostly 20–30 μ long, branching opposite or irregular, becoming closely reticulate. Capitate hyphopodia alternate, more or less bent, 22–35 μ long; stalk cell cylindrical, bent, 7–15 μ long; head cell versiform, from rounded-angulose to irregularly lobed, often bent, 15–25 \times 12–18 μ . Mucronate hyphopodia mixed with capitate, alternate or opposite, bent ampulliform, 17–25 \times 8–10 μ , neck upturned, 3–4 μ thick. Setae none. Perithecia scattered, each on radiate disc, black, globose, verrucose, up to 330 μ diam., surface cells conical, projecting up to 25 μ . Spores dark brown, bent ellipsoid, obtuse, 3-septate, slightly constricted, 54–69 \times 17–20 μ .

(38) *IRENINA AUSTRALIANA* Hansf., n. sp. (3101.4240). (Fig. 25.)

Plagulae epiphyllae, atrae, densae, leves, 1–2 mm. diam. vel confluentes. Mycelium ex hyphis atrobrunneis, tortuosis, 6–7 μ crassis (cellulis plerumque 15–25 μ longis), opposita vel irregulariter ramosis, dense reticulatis compositum. Hyphopodia capitata alternata, rarissime etiam opposita, recta vel curvula, 11–21 μ longa, cellula basali cylindracea 2–8 μ longa, cellula apicali cylindraceo-clavata, integra, saepe curvula, 8–15 \times 7–11 μ . Hyphopodia mucronata illis capitatis commixta, opposita vel alternata, ampullacea, curvata, 15–25 \times 7–9 μ , collo suberecto 3 μ crasso praedita. Setae nullae. Perithecia dispersa, atra, globosa, verrucosa, usque ad 350 μ diam., cellulis parietis concis, usque ad 25 μ alt. Sporae atrobrunneae, cylindraceae vel subellipsoideae, obtusae, 4-septatae, constrictae, 42–49 \times 17–19 μ .

Hab. in foliis *Eucalypti*, spec. indet., Brisbane, Qld., Bailey s.n. (typus in Herb. Queensland, Brisbane); Bellbrook, N.S.W., Fraser 182 p.p.

In both these collections this species mixed with *I. eucalyptorum*.

Colonies epiphyllous, black, dense, smooth, 1–2 mm. diam. or confluent. Mycelium of crooked dark brown hyphae 6–7 μ thick, the cells mostly 15–25 μ long, branching opposite or irregular, forming a close reticulum. Capitate hyphopodia alternate, very rarely opposite, straight or bent, 11–21 μ long; stalk cell cylindrical, 2–8 μ long; head cell cylindrical-clavate, entire, often more or less bent, 7–15 \times 7–11 μ . Mucronate hyphopodia

scattered amongst capitate, opposite or alternate, bent ampulliform, $15-25 \times 7-9\mu$. Setae none. Perithecia scattered, black, globose, up to 350μ diam., verrucose, the surface cells conical, projecting up to 25μ ; each perithecium seated on a radiate disc of exhyphopodiae. Spores dark brown, cylindrical with rounded ends, 4-septate, constricted, $42-49 \times 17-19\mu$.

Family OLEACEAE.

(39) *MELIOLA NOTELAEAE* Hansf., n. sp. (3111.5321). (Fig. 26.)

Plagulae amphigenae, atrae, densae, velutinae, usque ad 3 mm. diam. vel confluentes. Mycelium ex hyphis atrobrunneis, subrectis vel undulatis, $6-7\mu$ crassis (cellulis plerumque $20-25\mu$ longis), opposite acutaeque ramosis, dense reticulatis compositum. Hyphopodia capitata alternata, plus minusve antrorsa, recta vel curvata, $18-28\mu$ longa, cellula basali cylindracea, $4-11\mu$ longa, cellula apicali oblonga, piriformia integraque, vel irregulariter sinuoso-curvata et sublobata, $12-18 \times 9-12\mu$. Hyphopodia mucronata pauca, illis capitatis commixta, alternata vel opposita, ampullacea, $20-25 \times 6-8\mu$, collo suberecto, 3μ crasso praedita. Setae myceliales numerosae, erectae, rectae, simplices, obtusae vel subacutae, usque ad $270 \times 7-9\mu$. Perithecia dispersa, atra, globosa, verrucosa, usque ad 200μ diam. Sporae atrobrunneae, cylindraceae, obtusae, 4-septatae, constrictae, $43-52 \times 17-20\mu$.

Hab. in foliis *Notelaeae reticulatae*, Grafton N.S.W., Fraser 197 (typus in Herb. Dept. Agric., Sydney); in foliis *N. longifoliae*, Church Point, N.S.W., Fraser 160; in foliis *N. venosae*, National Park, N.S.W., Fraser 13C, 13D.

Colonies amphigenous, black, dense, velvety, up to 3 mm. diam. or sometimes confluent. Mycelium of substraight to undulate dark brown hyphae $6-7\mu$ thick, the cells mostly $20-25\mu$ long, branching usually opposite at acute angles, densely reticulate. Capitate hyphopodia alternate, more or less antrorse, straight or bent, $18-28\mu$ long; stalk cell cylindrical, $4-11\mu$ long; head cell from oblong-piriform and entire to irregularly sinuoso-bent and sublobate, $12-18 \times 9-12\mu$. Mucronate hyphopodia few, mixed with capitate, alternate or opposite, bent ampulliform, $20-25 \times 6-8\mu$, neck upturned, 3μ thick. Mycelial setae numerous, erect, straight, simple, obtuse to acute, up to $270 \times 7-9\mu$. Perithecia scattered, black, globose, verrucose, up to 200μ diam. Spores dark brown, cylindrical, obtuse, 4-septate, constricted, $43-52 \times 17-20\mu$.

Family PROTEACEAE.

(40) *MELIOLA LANOSA* Pat., in *Rev. Mycol.*, 10: 136, 1888.

= *Meliola funerea*, McAlp., Proc. LINN. Soc. N.S.W., 21: 104, 1896.

= *Meliola macrocarpa* Mont. in *Herb. Mus. Paris, pro parte*.

= *Meliola negeriana* Syd. in *Ann. Mycol. Berl.*, 2: 170, 1904 (2111.6341).

The type was described on *Lomatia* sp. in Chile, as was Sydow's species, of which I find the type to be identical with Australian collections.

Colonies amphigenous, mostly epiphyllous, dense, subcrustose, velvety, black, numerous but not usually confluent. Mycelium of dark brown hyphae, $8-11\mu$ thick, the cells mostly $20-30\mu$ long, flexuous to undulate, branching usually opposite at wide angles, closely reticulate and with the hyphopodia almost solid in the centre. Capitate hyphopodia alternate, more or less bent, antrorse, $26-34\mu$ long; stalk cell cylindrical, $5-11\mu$ long; head cell very irregularly and shallowly palmately 3-7-lobed, the lobes blunt, $18-25 \times 15-23\mu$. On the lower surface of the leaves the head cells are less lobed, but even more irregular in shape and the hyphae more crooked. Mucronate hyphopodia few, mixed with capitate, alternate, bent ampulliform, $15-20 \times 7-10\mu$, neck suberect, short, $3-4\mu$ thick. Mycelial setae numerous, erect, straight, black, simple, acute, up to $540 \times 10-11\mu$. Perithecia in loose central group, black, globose, verrucose, up to 420μ diam. Spores dark brown, bent cylindrical, 3-septate, constricted, obtuse at ends, $50-64 \times 20-24\mu$.

On leaves of *Lomatia* sp., Taggerty, Vict., Dixon, May, 1930; on *L. fraseri*, South Gippsland, Vict., July, 1891, C. French; on *L. arborescens*, Williams R., N.S.W., Fraser 141, 204; on *L. myricoides*, National Park, N.S.W., Fraser 48; on *L. silaifolia*, Lauriston,

N.S.W., Fraser 123; on *Stenocarpus satignus*, Williams R., N.S.W., Fraser 110, 223; on *Orites excelsa*, Williams R., N.S.W., Fraser 109; on *Grevillea robusta*, Lismore, N.S.W., J. H. Maiden, March, 1896 (type of *M. funerea* McAlp.).

Family RANUNCULACEAE.

(41) MELIOLA KNOWLTONIAE Doidge, in *Bothalia*, 1: 308, 1924 (3111.4222).

Colonies mostly epiphyllous, thin to subdense, black, up to 2 mm. diam. Mycelium of substraight to undulate dark brown hyphae 8–10 μ thick, the cells mostly 30–40 μ long, branching opposite at acute angles, closely reticulate. Capitulate hyphopodia alternate, more or less antrorse, 27–35 μ long; stalk cell cylindrical, 5–10 μ long; head cell from subglobose to cylindrical with rounded, often recurved apex, sometimes rounded-angulose to sublobate, 20–28 \times 10–13 μ . Mucronate hyphopodia fairly numerous, mixed with capitulate, opposite or alternate, bent ampulliform, 16–20 \times 7–9 μ , neck short, upturned, 3 μ thick. Mycelial setae mostly around the perithecia, erect, straight or slightly bent, up to 450 \times 9–10 μ , apex acute or subacute. Perithecia in central group, black, globose, verrucose, up to 190 μ diam. Spores dark brown, cylindrical to ellipsoid, obtuse, 4-septate, constricted, 40–47 \times 17–19 μ .

On *Clematis glycinoides*, National Park, N.S.W., Fraser 27, 176.

Family RHAMNACEAE.

(42) MELIOLA EMMENOSPERMATIS Hansf., n. sp. (3123.5232). (Fig. 27.)

Plagulae hypophyllae, atrae, densae, usque ad 5 mm. diam. vel confluentes, subcrustosae. Mycelium ex hyphis atrobrunneis, rectis vel undulatis, 7–8 μ crassis (cellulis plerumque 15–25 μ longis), opposita lateque ramosis, dense reticulatis compositum, in centro plagularum subsolidum. Hyphopodia capitata alternata vel usque ad 3% opposita, plus minusve antrorsa, recta vel curvata, 13–24 μ longa, cellula basali cylindracea, 3–10 μ longa, cellula apicali subglobosa vel piriformia, integra, 10–17 \times 7–11 μ . Hyphopodia mucronata pauca, illis capitatis commixta, alternata vel opposita, ampullacea, curvata, 15–20 \times 7–9 μ , collo suberecto, 3 μ crasso praedita. Setae myceliales numerosae, erectae, irregulariter flexuosae, arcuatae vel subuncinatae, simplices, obtusae, usque ad 450 \times 8–10 μ . Perithecia dispersa, atra, globosa, verrucosa, usque ad 220 μ diam. Spores atrobrunneae cylindraceae, obtusae, 4-septatae, constrictae, 48–55 \times 17–19 \times 14–16 μ .

Hab. in foliis *Emmenospermatis alphonoidis*, Williams R., N.S.W., Fraser 212 (typus in Herb. Dept. Agric., Sydney).

Colonies hypophyllous, black, dense, to 5 mm. diam or sometimes confluent, subcrustose. Mycelium of substraight to undulate dark brown hyphae 7–8 μ thick, the cells mostly 15–25 μ long, branching opposite at wide angles, closely reticulate and solid in centre of older colonies. Capitulate hyphopodia alternate or about 3% opposite, more or less antrorse, straight or bent, 13–24 μ long; stalk cell cylindrical, 3–10 μ long; head cell subglobose to piriform, entire, 10–17 \times 7–11 μ . Mucronate hyphopodia few, mixed with capitulate, alternate or opposite, bent ampulliform, 15–20 \times 7–9 μ , neck upturned, 3 μ thick. Mycelial setae numerous, erect, irregularly flexuous, arcuate or subuncinate, simple, obtuse, up to 450 \times 8–10 μ . Perithecia scattered, black, globose, verrucose, to 220 μ diam. Spores dark brown, cylindrical, obtuse, 4-septate, constricted, 48–55 \times 17–19 \times 14–16 μ .

(43) MELIOLA POMADERRIDIS Hansf., in *Proc. Linn. Soc. London*, 157: 179, 1946 (2111.4232).

Colonies epiphyllous, black, rather dense, velvety, up to 3 mm. diam. Mycelium of closely reticulate, irregularly branched, dark brown, substraight hyphae 7–9 μ thick, the cells mostly 20–32 μ long. Capitulate hyphopodia alternate, somewhat antrorse, straight or bent, 26–35 μ long; stalk cell cylindrical-cuneate, 6–16 μ long; head cell irregularly lobed, versiform, 18–23 \times 12–20 μ . Mucronate hyphopodia few, mixed with capitulate, alternate or opposite, ampulliform with short bent neck. Mycelial setae numerous, erect, substraight, not uncinata, apex attenuate-rounded but not acute, up to 350 \times 9–10 μ . Perithecia scattered, black, globose, verrucose, up to 230 μ diam. Spores dark brown, bent ellipsoid, obtuse, 3-septate, constricted, 41–48 \times 16–17 μ .

On *Pomaderris apetala*, Tasmania, Rodway 833 (type in Herb. Pretoria, also in Herb. Tasmania); Mt. Drummer, Vict., Fraser 194; Clyde Mountain, N.S.W., Fraser 155; Warburton, Vict., French and Brittlebank.

Family ROSACEAE.

- (44) *IRENE CALOSTROMA* (Desim.) von Hoehnel in *Ann. Mycol.*, Berlin, 16: 213, 1918 (2201.4220).

Colonies mostly epiphyllous, rather thin, up to 2 mm. diam., sometimes causing a red leaf-spot on host, sometimes numerous and widely confluent. Mycelium of dark brown, substraight to undulate hyphae 6-8 μ thick, the cells mostly 20-30 μ long, branching opposite or irregular, loosely reticulate. Capitae hyphopodia alternate, more or less antrorse, straight or bent, 20-35 μ long; stalk cell cylindrical, 5-18 μ long; head cell sometimes subglobose to piriform and entire, more usually rounded-angulose to irregularly and shallowly lobed, 12-20 \times 11-17 μ . Mucronate hyphopodia mixed with capitate, fairly numerous, opposite or alternate, ampulliform, 14-24 \times 6-9 μ , neck upturned, 3 μ thick. Setae none. Perithecia usually in a central group, black, globose, rough, up to 250 μ diam., the surface cells conic to mammillate, but some growing out into larviform appendages 60-110 μ long, 20-25 μ diam. at the base, recurved above and tapering to obtuse apex, brown, somewhat translucent, transversely striate. Spores dark brown, cylindrical, straight or somewhat bent, obtuse, 3-septate, slightly constricted, 38-45 \times 13-15 μ .

On *Rubus moluccanus*, Williams R., N.S.W., Fraser 112; Megalong Valley, Blackheath, N.S.W., Fraser 206; National Park, N.S.W., Fraser 6, 163.

Family RUBIACEAE.

- (45) *MELIOLA WOODIANA* Sacc. in *Hedwigia* 38: 132, 1899 (3121.5332).

Colonies mostly frequently epiphyllous, very dense, velvety, up to 3 mm. diam. or confluent and larger. Mycelium of radiating, dark brown, straight or slightly undulate hyphae 6-9 μ thick, the cells 15-30 μ long, branching opposite at acute angles, densely reticulate and nearly solid. Capitae hyphopodia alternate, more or less closely antrorse, 20-30 μ long; stalk cell somewhat cuneate, 4-12 μ long; head cell ovate or slightly rounded-angulose, 14-22 \times 9-14 μ . Mucronate hyphopodia on separate hyphae, not numerous, opposite or alternate, ampulliform with short upturned neck 3-4 μ thick, 12-20 \times 7-10 μ . Mycelial setae numerous, closely scattered, curved to falcate-uncinate, simple, acute to obtuse, up to 400 \times 8-11 μ . Perithecia scattered, black, globose, verrucose, up to 230 μ diam. Spores dark brown, cylindrical to subellipsoid, 4-septate, constricted, 40-54 \times 16-21 μ , ends obtuse.

On *Morinda jasminoides*, Williams R., N.S.W., Fraser 52.

Family RUTACEAE.

- (46) *MELIOLA KISUBIENSIS* Hansf., var. *PHEBALII-DENTATI* Hansf., n. var. (3131.4321). (Fig. 28.)

Plagulae epiphyllae, densae, usque ad 1 mm. diam. vel confluentes. Mycelium ex hyphis brunneis, subrectis, 7-9 μ crassis (cellulis plerumque 15-20 μ longis), opposite lateque ramosis, dense reticulatis compositum, in centro plagarum subsolidum. Hyphopodia capitata alternata, saepius subrecta et plus minusve antrorsa, 17-27 μ longa; cellula basali cylindracea, 5-9 μ longa, cellula apicali ovata vel cylindracea, apice rotundata, integra, 12-18 \times 9-11 μ . Hyphopodia mucronata pauca, illis capitatis commixta, saepius alternata, ampullacea, curvata, 15-20 \times 7-9 μ , collo suberecto, 3 μ crasso praedita. Setae myceliales paucae, dispersae, etiam juxta perithecia aggregatae, erectae, rectae, usque ad 230 \times 8-9 μ , apice simplices acutaeque vel 2-dentatae usque ad 8 μ . Perithecia laxae aggregata, atra, globosa, verrucosa, usque ad 180 μ diam. Sporae atrobrunneae, cylindraceae vel ellipsoideae, 4-septatae, constrictae, 45-50 \times 17-21 μ , obtusae.

Hab. in foliis *Phebalii dentati*, Berowra, N.S.W., Fraser 7 (typus in Herb. Dept. Agric., Sydney).

Colonies epiphyllous, dense, to 1 mm. diam. or sometimes confluent. Mycelium of substraight dark brown hyphae 7-9 μ thick, the cells mostly 15-20 μ long, branching opposite at wide angles, closely reticulate and almost solid in centre. Capitae hyphopodia alternate, mostly straight and more or less antrorse, 17-27 μ long; stalk cell cylindrical, 5-9 μ long; head cell ovate-cylindrical with rounded apex, entire, 12-18 \times 9-11 μ .

Mucronate hyphopodia few, mixed with capitate, mostly alternate, bent ampulliform $15-20 \times 7-9\mu$, neck upturned, 3μ thick. Mycelial setae rather sparse, scattered and around the perithecia, erect, straight, up to $230 \times 8-9\mu$, apex simple and acute or 2-dentate to 8μ . Perithecia in loose central group, black, globose, verrucose, up to 180μ diam. Spores dark brown, cylindrical to ellipsoid, 4-septate, constricted, $45-50 \times 17-21\mu$. In some colonies about 1% of capitate hyphopodia are opposite.

(47) *MELIOLA KISUBIENSIS* Hansf., var. *BOSISTOAE* Hansf., n. var. (3111.5332). (Fig. 29.)

Plagulae saepius hypophyllae, densae, velutinae, usque ad 2 mm. diam. Mycelium ex hyphis atrobrunneis, subrectis vel undulatis, $7-8\mu$ crassis (cellulis plerumque $20-25\mu$ longis), opposite lateque ramosis, dense reticulatis compositum. Hyphopodia capitata alternata, plus minusve curvata, saepe antrorsa, $18-25\mu$ longa, cellula basali cylindracea, $5-9\mu$ longa, cellula apicali cylindracea apice rotundata, recta vel curvula, $11-21 \times 8-11\mu$. Hyphopodia mucronata illis capitatis commixta, pauca, alternata vel opposita, ampullacea, curvata, $14-23 \times 7-9\mu$, collo suberecto, $3-4\mu$ crasso praedita. Setae myceliales paucae vel numerosae, erectae, rectae, simplices, acutae, usque ad $500 \times 9-11\mu$. Perithecia laxae aggregata, atra, globosa, verrucosa, usque ad 260μ diam. Spores atrobrunneae, cylindraceae, obtusae, 4-septatae, constrictae, $44-53 \times 19-23 \times 16-18\mu$.

Hab. in foliis *Bosistoe evodiiformis*, Bulga, N.S.W., Fraser 51 (typus in Herb. Dept. Agric., Sydney).

Colonies mainly hypophyllous, dense, velvety, to 2 mm. diam. Mycelium of substraight to undulate dark brown hyphae $7-8\mu$ thick, the cells mostly $20-25\mu$ long, branching opposite at wide angles, closely reticulate. Capitate hyphopodia alternate only, more or less bent, often antrorse, $18-25\mu$ long; stalk cell cylindrical, $5-9\mu$ long; head cell cylindrical with rounded apex, often bent, $11-21 \times 8-11\mu$. Mucronate hyphopodia mixed with capitate, few, alternate or opposite, bent ampulliform, $14-23 \times 7-9\mu$, neck ascending, $3-4\mu$ thick. Mycelial setae few to numerous, erect, straight, simple, acute, or subacute, up to $500 \times 9-11\mu$. Perithecia in a central group, black, globose, verrucose, up to 260μ diam. Spores dark brown, cylindrical, obtuse, 4-septate, constricted, $44-55 \times 19-23 \times 16-18\mu$.

(48) *MELIOLA KISUBIENSIS* Hansf., var. *MEDICOSMAE* Hansf., n. var. (3111.5331). (Fig. 30.)

Plagulae epiphyllae, atrae, densae, 1-2 mm. diam., subcrustosae. Mycelium ex hyphis atrobrunneis, subrectis, $8-10\mu$ crassis (cellulis plerumque $15-20\mu$ longis), opposite ramosis, dense reticulatis compositum, subsolidum. Hyphopodia capitata alternata, rarissime etiam opposita, leniter antrorsa, $20-30\mu$ longa, cellula basali cylindracea, $5-10\mu$ longa, cellula apicali ovata vel cylindraceo-clavata, integra, apice rotundata, $15-22 \times 10-14\mu$. Hyphopodia mucronata illis capitatis commixta, opposita vel alternata, ampullacea, collo curvato praedita. Setae myceliales paucae, dispersae, erectae, rectae, usque ad $280 \times 9-11\mu$, apice obtusae vel subacutae. Perithecia dispersa, atra, globosa, verrucosa, usque ad 240μ diam. Spores atrobrunneae, cylindraceae vel ellipsoideae, obtusae, 4-septatae, constrictae, $50-56 \times 20-23\mu$.

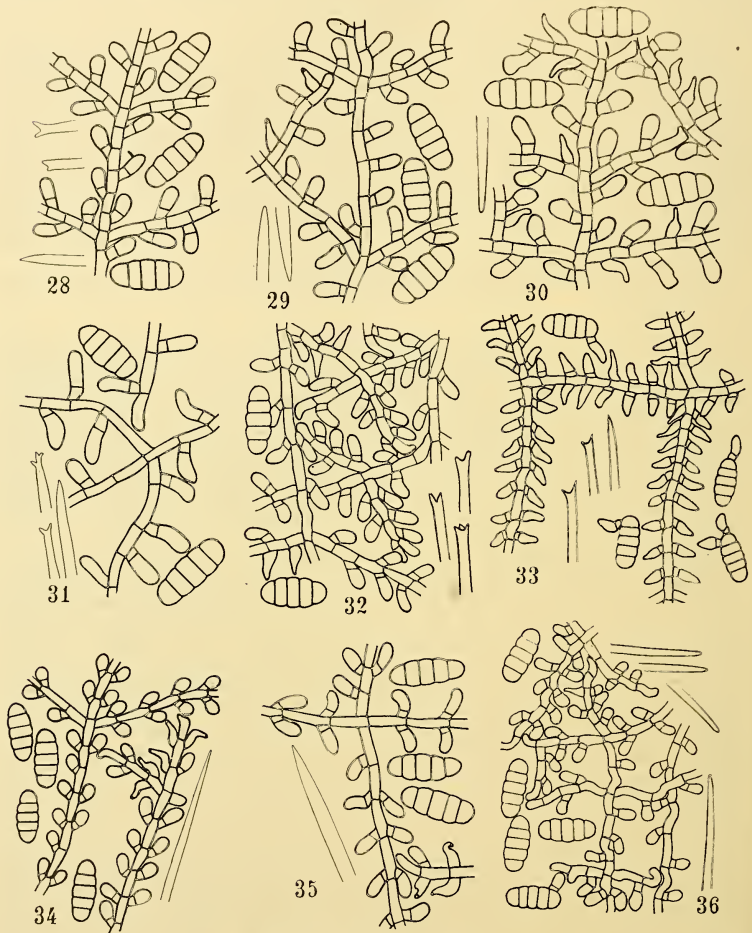
Hab. in foliis *Medicosmae cunninghamii*, Goodna, Qld., C. T. White (typus in Herb. Queensland, Brisbane).

Colonies epiphyllous, black, dense, 1-2 mm. diam., subcrustose. Mycelium of dark brown hyphae, substraight, $8-10\mu$ thick, the cells mostly $15-20\mu$ long, branching opposite at wide angles, forming an almost solid network. Capitate hyphopodia alternate, rarely also opposite, slightly antrorse, $20-30\mu$ long; stalk cell cylindrical, $5-10\mu$ long; head cell ovate to cylindrical-clavate, entire, widely rounded at apex, rarely with few blunt lobes, usually straight, $15-22 \times 10-14\mu$. Mucronate hyphopodia scattered amongst capitate, opposite or alternate, ampulliform with bent neck. Mycelial setae few, scattered, straight, up to $280 \times 9-11\mu$, erect, obtuse to subacute. Perithecia scattered, each on radiate disc, up to 240μ diam., black, flattened globose, verrucose. Spores dark brown, cylindrical to ellipsoid with rounded ends, 4-septate, constricted, $50-56 \times 20-25\mu$.

Many colonies are completely devoid of setae. Occasionally the capitate hyphopodia are rounded-angulose, and they are on average distinctly larger than those of the two preceding varieties.

(49) MELIOLA BOUCHARDATIAE Hansf., n. sp. (31&1.5332). (Fig. 31.)

Plagulae hypophyllae, subtenuae, usque ad 3 mm. diam. vel confluentes, effusae, tenuiter velutinae. Mycelium ex hyphis atrobrunneis, subrectis vel undulatis, 7-9 μ crassis (cellulis plerumque 20-30 μ longis), opposite vel irregulariter ramosis, laxe



Text-figures 28-36 ($\times 250$.)

28, *Meliola kisubiensis* var. *pheballi-dentati*. 29, *M. kisubiensis* var. *bosistoae*. 30, *M. kisubiensis* var. *medicosmae*. 31, *M. bouchardatae*. 32, *M. baileyi*. 33, *M. capensis* var. *baileiana*. 34, *M. capensis* var. *diptoglottidis*. 35, *M. fraseri*. 36, *M. alectryonis*.

reticulatis compositum. Hyphopodia capitata alternata, patentia, recta vel curvula, 22-37 μ longa, cellula basali cylindracea vel cuneata, 4-11 μ longa, cellula apicali cylindracea apice rotundata, saepe curvata, 17-28 \times 8-11 μ . Hyphopodia mucronata illis capitatis commixta, alternata, ampullacea, curvata, 15-22 \times 7-9 μ , collo suberecto, 2 μ crasso

praedita. Setae myceliales dispersae, etiam juxta perithecia aggregatae, erectae, rectae, usque ad $450 \times 9-11\mu$, apice acutae vel 2-3-dentatae usque ad 7μ . Perithecia dispersa, atra, globosa, verrucosa, usque ad 240μ diam. Sporae atrobrunneae, cylindratae, obtusae, 4-septatae, constrictae, $45-56 \times 19-22\mu$.

Hab. in foliis *Bouchardatae neurococcae*, Mt. Warning, N.S.W., Fraser 230 (typus in Herb. Dept. Agric., Sydney).

Colonies hypophyllous, rather thin, to 3 mm. diam. or confluent and effuse, thinly velvety. Mycelium of substraight to undulate dark brown hyphae $7-9\mu$ thick, the cells mostly $20-30\mu$ long, branching opposite or irregular at wide angles, loosely reticulate. Capitata hyphopodia alternate, at wide angles, straight or bent, $22-37\mu$ long; stalk cell cylindric or cuneate, $4-11\mu$ long; head cell cylindric with rounded apex, often bent, $17-26 \times 8-11\mu$. Mucronate hyphopodia mixed with capitata, alternate, bent ampulliform, $15-22 \times 7-9\mu$, neck upturned, 3μ thick. Mycelial setae scattered and around the perithecia, erect, straight, up to $450 \times 9-11\mu$, apex simple and acute or 2-3-dentate to 7μ . Perithecia scattered, black, globose, verrucose, up to 240μ diam. Spores dark brown, cylindric, obtuse, 4-septate, constricted, $45-56 \times 19-22\mu$.

(50) MELIOLA BAILEYI Hansf., n. sp. (3133.4222). (Fig. 32.)

Plagulae hypophyllae, 1-2 mm. diam. vel numerosae et confluentes, densae. Mycelium ex hyphis atrobrunneis, subrectis, $7-9\mu$ crassis (cellulis plerumque $15-25\mu$ longis), opposite lateque ramosis, dense reticulatis compositum, in centro plagularum sub-solidum. Hyphopodia capitata opposita vel alternata, antrorsa, $15-23\mu$ longa, cellula basali cylindrata, $3-8\mu$ longa, cellula apicali ovata vel cylindrata, apice rotundata, integra, interdum curvata, $11-18 \times 7-10\mu$. Hyphopodia mucronata illis capitatis commixta, alternata vel opposita, ampullacea, collo curvato. Setae myceliales dispersae, numerosae, erectae, rectae, usque ad $320 \times 8-10\mu$, obtusae vel saepius 2-3-dentatae usque ad 10μ . Perithecia dispersa, atra, globosa, verrucosa, usque ad 180μ diam. Sporae atrobrunneae, cylindratae vel ellipsoideae, obtusae, 4-septatae, constrictae, $43-48 \times 18-20\mu$.

Hab. in foliis *Flindersiae collinae*, Brisbane, Qld., Bailey 611 (typus in Herb. Queensland, Brisbane); in foliis *Eriostemi lanceolati*, Wahroonga, N.S.W., Fraser 152; in foliis *Phebalii squamulosi*, National Park, N.S.W., Fraser 7A; in foliis Rutacearum spec. indet., Brisbane, Qld., Bailey 645.

Colonies hypophyllous, 1-2 mm. diam., or numerous and confluent, black, dense. Mycelium of substraight dark brown hyphae, $7-9\mu$ thick, the cells mostly $15-25\mu$ long; branching opposite at wide angles, forming a close network and almost solid in the centre. Capitata hyphopodia opposite or alternate, antrorse, $15-23\mu$ long; stalk cell cylindric, $3-8\mu$ long; head cell ovate to cylindric with rounded apex, entire, sometimes slightly bent, $11-18 \times 7-10\mu$. Mucronate hyphopodia mixed with capitata, alternate or opposite, ampulliform with bent neck. Mycelial setae thickly scattered, erect, straight, up to $320 \times 8-10\mu$ thick at the base, obtuse or usually 2-3-dentate to 10μ . Perithecia scattered, black, globose, verrucose, up to 180μ diam. Spores dark brown cylindric, obtuse, 4-septate, constricted, $43-48 \times 18-20\mu$.

The specimen on *Eriostemon lanceolatus* has the colonies amphigenous and velvety, the perithecia up to 240μ diam., with spores $45-54 \times 19-22 \times 15-17\mu$. The spores of Fraser 7A on *Phebalium squamulosum* measure only $40-47 \times 17-20\mu$ and the mycelial setae reach 540μ in length. In Herb. Kew the host of Bailey 645 is labelled *Citrus australis*.

Family SAPINDACEAE.

(51) MELIOLA CAPENSIS (K. & C.) Theiss., var. BAILEYANA Hansf., n. var. (3142.3222). (Fig. 33.)

Plagulae epiphyllae, atrae, 1-2 mm. diam., subdensae. Mycelium ex hyphis atrobrunneis, subrectis, $7-8\mu$ crassis (cellulis plerumque $10-20\mu$ longis), opposite sub-rectangulariter ramosis, dense reticulatis compositum. Hyphopodia capitata opposita, leniter antrorsa, $12-20\mu$ longa, cellula basali cylindrata, $2-5\mu$ longa, cellula apicali cylindrata vel subconoidea, apice rotundata, saepe leniter recurvata, $10-16 \times 7-9\mu$.

Hypophodia mucronata illis capitatis commixta, opposita vel alternata, ampullacea, curvata, 18–23 × 6–8 μ , collo suberecto, 3 μ crasso praedita. Setae myceliales laxae dispersae, erectae, rectae, usque ad 320 × 7–9 μ , apice acutae vel 2–3-dentatae usque ad 10 μ . Perithecia dispersa, atra, globosa, verrucosa, usque ad 180 μ diam. Sporae atrobrunneae, cylindratae vel ellipsoideae, obtusae, 4-septatae, constrictae, 34–38 × 14–16 μ .

Hab. in foliis Sapindacearum spec. indet., Tringithurra Creek, Qld., Bailey 817 p.p. (typus in Herb. Queensland, Brisbane).

Colonies epiphyllous, black, 1–2 mm. diam., rather dense. Mycelium of substraight dark brown hyphae 7–8 μ thick, the cells mostly 10–20 μ long, branching regular, opposite at near right angles, forming close network. Capitatae hypophodiae oppositae, close, somewhat antrorse but often reflexed towards the apex, 12–20 μ long; stalk cell short cylindric, 2–5 μ long; head cell cylindric to somewhat conic with rounded apex, often bent, 10–16 × 6–9 μ . Mucronatae hypophodiae frequent, mixed with capitatae, oppositae or alternatae, elongatae, bent ampulliform, 18–23 × 6–8 μ wide at base. Mycelial setae thinne scattate, erectae, straightae, apex simple and acute or 2–3-dentatae to 10 μ , up to 320 × 7–9 μ . Mature perithecia non seen, immature to 180 μ diam., black, globosae, verrucosae. Spores dark brown, cylindricae with rounded ends, 4-septatae, constrictae, smooth, 34–38 × 14–16 μ .

(52) MELIOLA CAPENSIS (K. & C.) Theiss., var. DIPLOGLOTTIDIS Hansf., n. var. (3112.4222).

(Fig. 34.)

Plagulae plerumque hypophyllae, subdensae, velutinae, usque ad 8 mm. diam. vel confluentes, in epiphyllis minores. Mycelium ex hyphis atrobrunneis, rectis, 6–7 μ crassis (cellulis plerumque circa 20 μ longis), oppositae lateque ramosis, laxae vel subdense reticulatae compositum. Hypophodia capitata opposita, plus minusve antrorsa, 13–21 μ longa, cellula basali cuneato-cylindrata, 3–6 μ longa, cellula apicali globosa vel oblonga, integra, 9–17 × 8–10 μ . Hypophodia mucronata illis capitatis commixta, opposita vel alternata, ampullacea, curvata, 15–25 × 6–8 μ , collo suberecto 3–4 μ crasso praedita. Setae myceliales dispersae, etiam juxta perithecia aggregatae, erectae, rectae, simplices, acutae, usque ad 400 × 7–8 μ . Perithecia dispersa, atra, globosa, verrucosa, usque ad 190 μ diam. Sporae atrobrunneae, cylindratae vel ellipsoideae, obtusae, 4-septatae, constrictae, 35–43 × 16–18 μ .

Hab. in foliis *Diploglottidis australis*, National Park, N.S.W., Fraser 164 (typus in Herb. Dept. Agric., Sydney); Williams R., N.S.W., Fraser 137.

Colonies mostly hypophyllous, rather dense, velvety, to 8 mm. diam., or sometimes confluent, much smaller on upper surface of leaf. Mycelium of straight dark brown hyphae 6–7 μ thick, the cells mostly about 20 μ long, branching opposite at wide angles, loosely to closely reticulate. On lower surface the hyphae less straight and the cells often longer. Capitatae hypophodiae almost entirely oppositae save where crowded, more or less antrorse, 13–21 μ long; stalk cell cuneate to cylindric, 3–6 μ long; head cell globosa to oblong, entire, 9–17 × 8–10 μ . Mucronatae hypophodiae mixed with capitatae, oppositae or alternatae, bent ampulliform, 15–25 × 6–8 μ , neck upturned, 3–4 μ thick. Mycelial setae scattate and around the perithecia, erectae, more or less straight, simple, acute, up to 400 × 7–8 μ , gradually attenuatae to apex. Perithecia scattate, black, globosae, verrucosae, up to 190 μ diam. Spores dark brown cylindricae to ellipsoidae, obtusae, 4-septatae, constrictae, 35–43 × 16–18 μ .

(53) MELIOLA FRASERI Hansf., n. sp. (3113.5333). (Fig. 35.)

Plagulae amphigenae, tenues vel subdensae, usque ad 8 mm. diam. vel confluentes et effusae. Mycelium ex hyphis atrobrunneis, subrectis vel undulatis, 7–8 μ (cellulis plerumque 25–30 μ longis), oppositae lateque ramosis, laxae reticulatae compositum. Hypophodia capitata alternata vel opposita (–90%), recta vel curvata, leniter antrorsa, vel recurvata, 17–25 μ longa, cellula basali cylindrata, 3–6 μ longa, cellula apicali cylindrata, apice rotundata, integra, 12–20 × 8–12 μ . Hypophodia mucronata pauca, illis capitatis commixta, alternata vel opposita, ampullacea, curvata, 15–22 × 7–9 μ , collo suberecto, 3–4 μ crasso praedita. Setae myceliales dispersae, etiam juxta perithecia aggregatae, erectae, rectae, simplices, acutae, usque ad 650 × 9–12 μ . Perithecia dispersa,

atra, globosa, verrucosa, usque ad 215μ diam. Sporae atrobrunneae, ellipsoideae, obtusae, 4-septatae, constrictae, $46-55 \times 18-21\mu$.

Hab. in foliis *Mischocarp*i spec., Williams R., N.S.W., Fraser 215 (typus in Herb. Dept. Agric., Sydney); in foliis Sapindacearum spec. indet., Hastings R., N.S.W., Fraser s.n., April, 1952.

Colonies amphigenous, thin to rather dense, up to 8 mm. diam. or confluent and effuse. Mycelium of substraight to undulate dark brown hyphae $7-8\mu$ thick, the cells mostly $25-30\mu$ long, branching usually opposite at wide angles, loosely reticulate, becoming close in centre of larger colonies. Capitae hyphopodia alternate or up to 90% opposite, straight or bent, at wide angles or somewhat antrorse, $17-25\mu$ long; stalk cell cylindric, $3-6\mu$ long; head cell cylindric with rounded apex, entire, often bent, $12-20 \times 8-12\mu$. Mucronate hyphopodia few, mixed with capitate, alternate or opposite, bent ampulliform, $15-22 \times 7-9\mu$, neck upturned, $3-4\mu$ thick. Mycelial setae scattered and around the perithecia, erect, straight, simple, acute, up to $650 \times 9-12\mu$. Perithecia scattered, black, globose, verrucose, up to 215μ diam. Spores dark brown, ellipsoid, obtuse, 4-septate, constricted, $46-55 \times 18-21\mu$.

(54) *MELIOLA FRASERI* Hansf., var. *MINOR* Hansf., n. var. (3113.4222).

Plagulae epiphyllae, 1-2 mm. diam., tenuissimae. Mycelium ex hyphis atrobrunneis, subrectis vel undulatis, $6-7\mu$ crassis (cellulis plerumque $25-40\mu$ longis), opposite acuteque ramosis, laxe reticulatis compositum. Hyphopodia capitata alternata vel usque ad 50% opposita, leniter antrorsa, $20-25\mu$ longa, cellula basali cylindracea, $3-7\mu$ longa, cellula apicali cylindraceo-clavata, integra, recta vel curvula, $14-19 \times 7-10\mu$. Hyphopodia mucronata illis capitatis commixta, alternata vel opposita, ampullacea, $19-23 \times 6-9\mu$. Setae myceliales tenuiter dispersae, erectae, rectae, simplices, acutae, usque ad $350 \times 7-10\mu$. Perithecia dispersa, atra, globosa, verrucosa, usque ad 190μ diam. Sporae atrobrunneae, cylindraceae vel ellipsoideae, obtusae, 4-septatae, constrictae, $40-44 \times 16-18\mu$.

Hab. in foliis Sapindacearum spec. indet., Tringithurra Creek, Qld., Bailey 817 p.p.

In the type this occurs mixed with *M. capensis* var. *baileyana*.

Colonies epiphyllous, black, 1-2 mm. diam., very thin. Mycelium of substraight to slightly undulate dark brown hyphae $6-7\mu$ thick, the cells mostly $25-40\mu$ long, branching usually opposite at acute angles, loosely reticulate. Capitae hyphopodia alternate or up to 50% opposite, somewhat antrorse, $20-25\mu$ long; stalk cell cylindric, $3-7\mu$ long; head cell regular, cylindric-clavate, rounded at apex, straight or slightly bent, $14-19 \times 7-10\mu$. Mucronate hyphopodia scattered amongst capitate, alternate or opposite, bent ampulliform, $19-23 \times 6-9\mu$. Mycelial setae thinly scattered, erect, straight, simple, acute, up to $350 \times 7-10\mu$. Mature perithecia up to 190μ diam., black, globose, verrucose. Spores dark brown, cylindric to ellipsoid, obtuse, 4-septate, constricted, $40-44 \times 16-18\mu$.

(55) *MELIOLA ALECTRYONIS* Hansf., n. sp. (3113.4222). (Fig. 36.)

Plagulae amphigenae, plerumque epiphyllae, etiam petiolicolae, tenuiter velutinae, 1-2 mm. diam., densae. Mycelium ex hyphis atrobrunneis, undulatis vel flexuosis, 7μ crassis (cellulis plerumque $15-20\mu$ longis), opposite lateque ramosis, dense reticulatis compositum. Hyphopodia capitata alternata vel opposita, recta vel curvata, plus minusve antrorsa, $11-19\mu$ longa, cellula basali cylindracea, $3-6\mu$ longa, cellula apicali ovata vel clavato-cylindracea, integra, $8-13 \times 7-9\mu$. Hyphopodia mucronata pauca, illis capitatis commixta, ampullacea, $13-17 \times 6-8\mu$, collo suberecto 3μ crasso praedita. Setae myceliales dispersae, erectae, rectae, simplices, obtusae, usque ad $330 \times 7-9\mu$. Perithecia dispersa, atra, globosa, verrucosa, usque ad 170μ diam. (immatura). Sporae atrobrunneae, cylindraceae vel ellipsoideae, obtusae, 4-septatae, constrictae, $37-42 \times 15-18\mu$.

Hab. in foliis *Alectryonis subcinerei*, Ballina, N.S.W., Baker 630 (typus in Herb. Dept. Agric., Melbourne); Williams R., N.S.W., Fraser 165.

Colonies amphigenous, mostly epiphyllous and on petioles, black, thinly velvety, 1-2 mm. diam., dense, not crustose. Mycelium of dark brown, undulate to flexuous hyphae 7μ thick, the cells mostly $15-20\mu$ long, branching usually opposite at wide angles, forming a close network. Capitae hyphopodia alternate or opposite, straight or bent,

usually more or less antrorse, 11–19 μ long; stalk cell cylindric, 3–6 μ long; head cell ovate to cylindric-clavate, widely rounded at apex, entire, 8–13 \times 7–9 μ . Mycelial setae scattered, erect, straight, black, opaque, simple, obtuse, up to 330 \times 7–9 μ . Perithecia scattered, black, flattened-globose, verrucose, immature (to 170 μ diam.). Spores dark brown, cylindric with obtuse ends, 4-septate, constricted, 37–42 \times 15–18 μ .

(56) *MELIOLA GUIOAE-SEMIGLAUCAE* Hansf., n. sp. (3113.5332). (Fig. 37.)

Plagulae saepius hypophyllae, tenues, effusae, usque ad 15 mm. diam. vel late confluentes, tenuiter velutinae. Mycelium ex hyphis atrobrunneis, subrectis vel flexuosis, 6–8 μ crassis (cellulis plerumque 20–30 μ longis), opposite lateque ramosis, laxe reticulatis compositum. Hyphopodia capitata alternata vel circa 2% opposita, recta vel curvata, in epiphyllis 20–30 μ longa, in hypophyllo saepe longiora, cellula basali 5–20 μ longa, cylindracea, recta vel curvata, cellula apicali oblonga vel late ovata, in hypophyllo subglobosa vel irregulariter rotundato-angulosa, 15–23 \times 10–14 μ . Hyphopodia mucronata illis capitatis commixta, alternata vel opposita, ampullacea, curvata, 16–22 \times 6–9 μ , collo suberecto, 3–4 μ crasso praedita. Setae myceliales dispersae, etiam juxta perithecia aggregatae, erectae, plus minusve rectae, simplices, acutae, usque ad 450 \times 7–9 μ . Perithecia laxa dispersa, atra, globosa, verrucosa, usque ad 210 μ diam. Sporae atrobrunneae, cylindraceae vel ellipsoideae, 4-septatae, constrictae, 45–54 \times 19–21 μ , obtusae.

Hab. in foliis *Guioae semiglaucae*, Williams R., N.S.W., Fraser 116 (typus in Herb. Dept. Agric., Sydney); National Park, N.S.W., Fraser 150, 86; Williams R., N.S.W., Fraser, April, 1952.

Colonies mostly hypophyllous, thin and effuse, up to 15 mm. diam. or widely confluent, thinly velvety. Mycelium of substraight to crooked dark brown hyphae 6–8 μ thick, the cells mostly 20–30 μ long, branching opposite at wide angles, loosely reticulate. Capitata hyphopodia alternate or about 2% opposite, straight or bent, on upper surface 20–30 μ long, on lower surface more variable with longer stalk cells; stalk cell 5–20 μ long, cylindric, straight or bent; head cell oblong to widely ovate, on lower surface from subglobose to irregularly rounded-angulose, 15–23 \times 10–14 μ . Mucronate hyphopodia mixed with capitata, alternate or opposite, bent ampulliform, 16–22 \times 6–9 μ , neck upturned, 3–4 μ thick. Mycelial setae scattered and around the perithecia, erect, more or less straight, simple, acute, up to 450 \times 7–9 μ . Perithecia loosely scattered, black, globose, verrucose, up to 210 μ diam. Spores dark brown, cylindric to ellipsoid, 4-septate, constricted, 45–54 \times 19–21 μ .

(57) *IRENINA DODONAEAE* Hansf., n. sp. (3103.4230). (Fig. 38.)

Plagulae amphigenae, usque ad 1 mm. diam., densae, leves, saepe numerosae sed raro confluentes. Mycelium ex hyphis atrobrunneis, 7–8 μ crassis (cellulis plerumque 15–20 μ longis), opposite lateque ramosis, dense reticulatis compositum, in centro plagularum subsolidum. Hyphopodia capitata opposita vel alternata, plus minusve antrorsa, 16–25 μ longa, cellula basali cylindracea, 4–10 μ longa, cellula apicali subglobosa vel late piriformia, integra, 12–16 \times 9–13 μ . Hyphopodia mucronata pauca, illis capitatis commixta, alternata vel opposita, ampullacea, curvata, 14–20 \times 7–9 μ , collo suberecto, 3–4 μ crasso praedita. Setae nullae. Perithecia in centro plagularum aggregata, atra, globosa, leniter verrucosa, usque ad 240 μ diam., cellulis parietis conoideis, vix prominentibus. Sporae atrobrunneae, cylindraceae, obtusae, 4-septatae, constrictae, 40–46 \times 16–18 μ .

Hab. in foliis *Dodonaeae triquetrae*, National Park, N.S.W., Fraser s.n., Nov., 1935 (typus in Herb. Dept. Agric., Sydney).

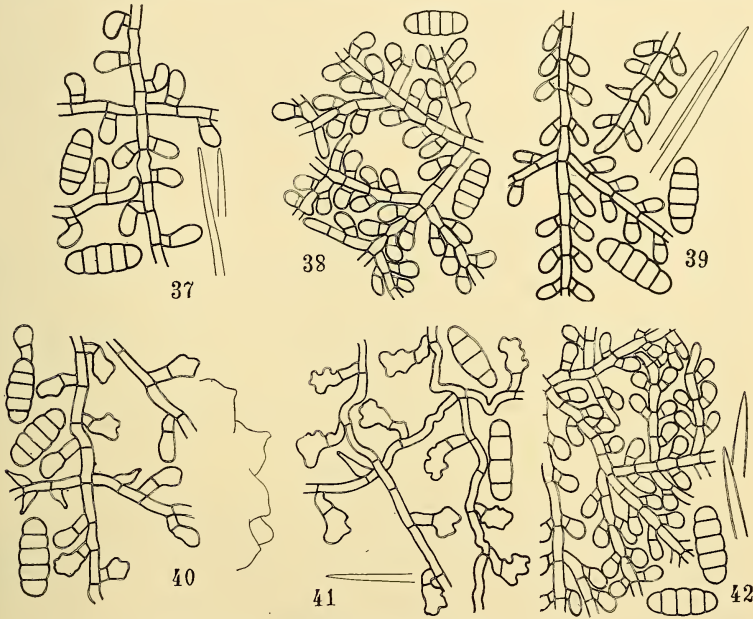
Colonies amphigenous, to 1 mm. diam., black, dense, smooth, often numerous but rarely confluent. Mycelium of substraight dark brown hyphae 7–8 μ thick, the cells mostly 15–20 μ long, branching opposite at wide angles, densely reticulate and almost solid. Capitata hyphopodia opposite or alternate, more or less antrorse, 16–25 μ long; stalk cell cylindric, 4–10 μ long, head cell subglobose to wide piriform, entire, 12–16 \times 9–13 μ . Mucronate hyphopodia few, mixed with capitata, alternate or opposite, bent

ampulliform, $14-20 \times 7-9\mu$, neck upturned, $3-4\mu$ thick. Setae none. Perithecia in central group, black, globose, slightly verrucose, up to 240μ diam., the surface cells rounded-conoid, scarcely projecting. Spores dark brown, cylindric, obtuse, 4-septate, constricted, $40-46 \times 16-18\mu$.

Family SMILACACEAE.

(58) MELIOLA RIPOGONI Hansf., n. sp. (3113.5331). (Fig. 39.)

Plagulae saepius epiphyllae, usque ad 5 mm. diam., densae, velutinae. Mycelium ex hyphis atrobrunneis, subrectis, $7-9\mu$ crassis (cellulis plerumque $20-25\mu$ longis), opposita acuteque ramosis, dense radianto-reticulatis compositum. Hyphopodia capitata opposita vel alternata, plus minusve antrorsa, recta vel curvula, $16-25\mu$ longa, cellula



Text-figures 37-42. ($\times 250$.)

37, *Meliola guioae-semigulaeae*. 38, *Irenina dodonaeae*. 39, *Meliola ripogoni*. 40, *Irenina duboisiae*. 41, *Meliola cissi-antarcticae*. 42, *M. lomandrae*.

basali cylindracea, $3-8\mu$ longa, cellula apicali subglobosa vel oblongo-cylindracea, apice late rotundata, integra, $12-18 \times 8-13\mu$. Hyphopodia mucronata pauca, illis capitatis commixta, ampullacea, curvata, $16-21 \times 8-9\mu$, collo suberecto, $3-4\mu$ crasso praedita. Setae myceliales numerosae, dispersae, erectae, rectae, simplices, obtusae vel acutae, usque ad $300 \times 8-10\mu$. Perithecia dispersa, atra, globosa, verrucosa, usque ad 220μ diam. Sporae atrobrunneae, cylindraceae vel ellipsoideae, obtusae, 4-septatae, constrictae, $46-56 \times 18-22\mu$.

Hab. in foliis *Ripogoni albi*, Williams R., N.S.W., Fraser 64 (typus in Herb. Dept. Agric., Sydney); *l.c.*, Fraser 122.

Colonies mostly epiphyllous, to 5 mm. diam., black, dense, becoming velvety. Mycelium of substraight dark brown hyphae $7-9\mu$ thick, the cells mostly $20-25\mu$ long, branching opposite at acute angles, densely radiating-reticulate. Capitulate hyphopodia opposite or less frequently alternate, more or less antrorse, usually straight, $16-25\mu$

long; stalk cell cylindric, 3–8 μ long; head cell from subglobose to oblong-cylindric, widely rounded at apex, entire, 12–18 \times 8–13 μ . Mucronate hyphopodia few, mixed with capitate, opposite or alternate, bent ampulliform, 16–21 \times 8–9 μ , neck upturned, 3–4 μ thick. Mycelial setae numerous, closely scattered, erect, straight, simple, obtuse to acute, up to 300 \times 8–10 μ . Perithecia scattered, black, globose, verrucose, up to 220 μ diam. Spores dark brown, cylindric-ellipsoid, obtuse, 4-septate, constricted, 46–56 \times 18–22 μ .

Family SOLANACEAE.

(59) *IRENINA DUBOISIAE* Hansf., n. sp. (3101.5330). (Fig. 40.)

Plagulae epiphyllae, densae, usque ad 1 mm. diam. vel confluentes, leves. Mycelium ex hyphis atrobrunneis, subrectis vel undulatis, 7–9 μ crassis (cellulis plerumque 20–25 μ longis), opposite lateque ramosis, dense reticulatis compositum. Hyphopodia capitata alternata, leniter antrorsa, recta vel curvula, 20–35 μ longa, cellula basali cylindracea, 5–15 μ longa, cellula apicali oblongo-clavata vel irregulariter rotundato-lobata, versiformia, 15–23 \times 12–18 μ . Hyphopodia mucronata illis capitatis commixta, opposita vel alternata, ampullacea, curvata, 15–20 \times 7–9 μ , collo suberecto, 3–4 μ crasso praedita. Setae myceliales nullae. Perithecia in centro plagularum laxe aggregata, atra, globosa, verrucosa, usque ad 270 μ diam., cellulis parietis conoideis vel mammillatibus, usque ad 20 μ alt. et ad basim 40 μ diam. Spores atrobrunneae, ellipsoideae, obtusae, 4-septatae, constrictae, 44–53 \times 19–22 \times 16–19 μ .

Hab. in foliis *Duboisiae myoporoidis*, Comboyne, N.S.W., Fraser 198 (typus in Herb. Dept. Agric., Sydney); Bulga, N.S.W., Fraser 67.

Colonies epiphyllous, dense, up to 1 mm. diam. or confluent, smooth. Mycelium of substraight to undulate dark brown hyphae 7–9 μ thick, the cells mostly 20–25 μ long, branching usually opposite, closely reticulate. Capitate hyphopodia alternate, somewhat antrorse, straight or bent, 20–35 μ long; stalk cell cylindric, 5–15 μ long; head cell oblong-clavate or irregularly rounded-lobate, versiform, 15–23 \times 12–18 μ . Mucronate hyphopodia mixed with capitate opposite or alternate, bent ampulliform, 15–20 \times 7–9 μ , neck upturned, 3–4 μ thick. Mycelial setae none. Perithecia in loose central group, black, globose, rough, up to 270 μ diam., surface cells conoid to mammillate, projecting up to 20 μ and about 40 μ diam. at the base. Spores dark brown, ellipsoid, obtuse, 4-septate, constricted, 44–53 \times 19–22 \times 16–19 μ .

Family VITACEAE.

(60) *MELIOLA CISSI-ANTARCTICAE* Hansf., n. sp. (2111.5232). (Fig. 41.)

Plagulae hypophyllae, raro etiam epiphyllae, 1–4 mm. diam. vel confluentes, tenues, tenuiter velutinae. Mycelium ex hyphis atrobrunneis, flexuosis, 6–7 μ crassis (cellulis plerumque 25–40 μ longis), opposite vel irregulariter ramosis, laxe reticulato-intertextis compositum. Hyphopodia capitata alternata, irregulariter curvata, 25–40 μ longa, cellula basali cylindracea, 7–17 μ longa, cellula apicali irregulariter stellato-lobata, saepe curvata, 18–25 \times 15–23 μ . Hyphopodia mucronata illis capitatis commixta, alternata, ampullacea, curvata, 20–28 \times 8–9 μ , collo suberecto, 3 μ crasso praedita. Setae myceliales subnumerosae, dispersae, etiam juxta perithecia aggregatae, erectae, rectae, simplices, acutae, usque ad 350 \times 7–8 μ . Perithecia dispersa, atra, globosa, verrucosa, usque ad 280 μ diam. Spores atrobrunneae cylindraceae vel ellipsoideae, 3-septatae, leniter constrictae, 40–53 \times 16–20 μ , cellulis terminalibus minoribus, zona subhyalino, angusto, subterminali praedita.

Hab. in foliis *Cissi antarcticae*, Hastings R., N.S.W., Fraser, April, 1952 (typus in Herb. Dept. Agric., Sydney).

Colonies hypophyllous mostly, 1–4 mm. diam. or confluent, thin, thinly velvety. Mycelium of crooked dark brown hyphae 6–7 μ thick, the cells mostly 25–40 μ long, branching opposite or irregular, closely reticulate-interwoven. Capitate hyphopodia alternate or more distant, irregularly bent, 25–40 μ long; stalk cell cylindric, 7–17 μ long; head cell very irregularly stellate-lobate and bent, 18–25 \times 15–23 μ . Mucronate hyphopodia mixed with capitate, alternate, bent ampulliform, 20–28 \times 8–9 μ , neck upturned, 3 μ thick. Mycelial setae fairly numerous, scattered and around the perithecia, erect, straight, simple, acute, up to 350 \times 7–8 μ . Perithecia scattered, black, globose,

verrucose, up to 280μ diam. Spores dark brown, cylindrical to ellipsoid, 3-septate, slightly constricted, $40-53 \times 16-20\mu$, the central cells much larger than the end cells, which have a faint subhyaline subterminal band, like those of *Meliolina* spp.

Family XANTHORRHOACEAE.

(61) MELIOLA LOMANDRAE Hansf., n. sp. (3113.5332). (Fig. 42.)

Plagulae amphigenae, atrae, densae, velutinae, crustosae, usque ad 3 mm. diam. Mycelium ex hyphis atrobrunneis, subrectis, $7-9\mu$ crassis (cellulis plerumque $15-30\mu$ longis), opposite ramosis, subsolide reticulatis compositum. Hyphopodia capitata opposita vel alternata, antrorsa, $15-23\mu$ longa; cellula basali cylindraca, $4-10\mu$ longa, cellula apicali subglobosa vel late ovata, integra, $10-15 \times 9-13\mu$. Hyphopodia mucronata pauca, illis capitatis commixta, alternata vel opposita, ampullacea, $15-20 \times 7-9\mu$, collo suberecto, $3-4\mu$ crasso praedita. Setae myceliales numerosissimae, dispersae, erectae, rectae, acutae, simplices, usque ad $340 \times 8-9\mu$. Perithecia subaggregata, atra, globosa, verrucosa, usque ad 210μ diam. Sporae atrobrunneae, cylindracaee vel subellipsoideae, obtusae, 4-septatae, constrictae, $48-53 \times 18-21\mu$.

Hab. in foliis *Lomandrae*, spec. indet., Queensland, H. Tryon 501 (typus in Herb. Queensland, Brisbane); *l.c.*, Bailey 634; in foliis *L. montanae*, Williams R., N.S.W., Fraser 220.

Colonies amphigenous, black, very dense, velvety, crustose, to 3 mm. diam. Mycelium of substraight dark brown hyphae $7-9\mu$ thick, the cells mostly $15-30\mu$ long, branching usually opposite at variable angles, forming almost a solid plate in centre. Capitulate hyphopodia opposite or alternate, antrorse, $15-23\mu$ long; stalk cell cylindrical, $4-10\mu$ long; head cell regular, entire, subglobose to widely ovate, $10-15 \times 9-13\mu$. Mucronate hyphopodia few, mixed with capitulate, alternate or opposite, ampulliform, $15-20 \times 7-9\mu$. Mycelial setae very numerous, scattered, erect, straight, acute, simple, up to $340 \times 8-9\mu$. Perithecia closely scattered, black, globose, verrucose, up to 210μ diam. Spores dark brown, cylindrical, obtuse, 4-septate, constricted, smooth, $48-53 \times 18-21\mu$.

In addition to the species recorded above, I have seen two other specimens from the Queensland Herbarium on undetermined hosts, which I have been unable to match with other species of *Meliola* or related genera. Until further collections of these can be made, and the hosts determined, it is not possible to describe them as new species.

Of the species previously recorded in Australia, which I have been able to trace, many obviously refer to one or other of those given above, though in some cases it is impossible to be certain of the exact species when more than one has been recorded on a host genus, and no specimens to substantiate these old records have been traced. In his Handbook of Australian Fungi, 1892, Cooke recorded the following:

Meliola corallina Mont.—All specimens of this species I have so far encountered are on *Drimys* spp. in South America, and although this host genus is recorded for Australia, I have seen no record of a true *Meliola* on it here.

Meliola amphitricha Fr.—The older mycologists used this name to include almost every *Meliola* they encountered, and, as was pointed out by Stevens, the true identity of the species is now irretrievably lost, so that the name must be abandoned.

Meliola musae Mont.—The host of this species has recently been determined for me at Kew as *Ravenala guyanensis*, and there is no record for any part of the world of this species on *Musa*; it appears to be limited to S. America. Cooke's record for Queensland on *Musa* can only be a mis-determination of a fungus not truly belonging to *Meliola*; there is no specimen in Herb. Kew.

Meliola orbicularis B. & C.—I have examined collections from the Queensland Herbarium, which appear to be correctly referred to this species; the host is a twig of an unknown plant. It appears to me very doubtful whether this fungus really belongs to *Meliola*, but further collections are required in fresh condition to elucidate its structure and parasitism.

Meliola loganiensis Sacc. & Berl., on *Smilax*, Qld.—According to description is not a *Meliola*, but probably belongs to Chaetothyriaceae.

Meliola octospora Cooke and *M. mollis* B. & Br. are now placed in the genus *Meliolina*, which is very doubtfully related to *Meliola*.

Meliola tetracerae Thuem. is, *ex descr.*, certainly not a true *Meliola*; Saccardo in *Syll. Fung.*, 14: 474, 1890, referred it to *Limacinia*, but re-examination is required of the type specimen before it can be placed with certainty. I have seen no Australian specimen to support Cooke's record.

STUDIES OF N-FIXING BACTERIA. III.

AZOTOBACTER BEIJERINCKII (Lipman, 1903), VAR. ACIDO-TOLERANS (Tchan, 1952).

By Y. T. TCHAN, Macleay Bacteriologist to the Society.

[Read 27th May, 1953.]

Synopsis.

Azotobacter beijerinckii (Lipman, 1903) *acido-tolerans* (Tchan, 1952), var. nov., is described. It can grow at pH 4.75 in media much too acid for other species of the genus.

It is generally accepted that the genus *Azotobacter* contains only species growing on a medium with a pH not much below 6. This property has been used by Derx (1950) to prevent the growth of *Azotobacter* by using an acid medium (pH = 5). In a previous work, *Azotobacter* has been successfully isolated from acid soils in the Sydney district (Tchan, 1952). The present paper describes the morphology and physiology of the species.

MORPHOLOGY.

The cells are rods to ellipsoids of $4-2 \times 3-1.5\mu$. Their cytoplasm is reduced to a kind of net by the presence of many fatty bodies staining with Sudan III. Cysts are readily formed in old cultures, especially with acetate as carbon source. They can be easily and specifically stained by the triple stain with violamin recommended by Winogradsky (1938). Living cells examined under the dark field or phase-contrast microscope did not show any motility nor in 0.2% agar medium. The controls with other *Azotobacter*, except *Azot. beijerinckii*, gave a typical culture of motile bacteria. This confirms the non-motility of *Azot. beijerinckii*.

The acid-fast stain gives red spots in the cells of all species of *Azotobacter*, but they are large and more numerous in *Azot. beijerinckii* and its new variety.

CULTURAL CHARACTERS.

For this study a Petri dish is divided into sectors. On the agar medium the new variety of *Azotobacter* is inoculated in one sector and in each of the others controls are inoculated (*Azotoc. agilis*, *Azot. chroococcum*, *Azot. vinelandii*, *Azot. beijerinckii*, *Beijerinckia indica*, *Beijerinckia indica* var. *alba*). Thus any variation due to the medium may be easily noticed by the abnormal growth of controls. Different sugars, organic acids and alcohols are used.

Glucose: On glucose, Winogradsky's salt agar medium, colonies appear within 24-48 hours; first white, then becoming yellow, but never brown-black. After two weeks the diameter of the colony may reach 1 cm. or sometimes more. The colour is then slightly ochreous. In liquid glucose medium the culture is first uniformly turbid and becomes cloudy. A yellow deposit can be seen after a week of incubation.

Sucrose, raffinose: Practically identical with glucose except a leaven (as described by Derx) is produced.

Maltose, inulin: Dark ochreous colour is developed after two weeks.

Mannose, galactose, rhamnose, xylose, lactose: The culture remains yellow after two weeks.

Dextrin: Identical with glucose.

Acetate, succinate (K or Na salt): The colony is first milky white and becomes lemon-yellow after two weeks.

Tartrate: Slightly ochreous after two weeks.

Benzoate: A typical benzoatase (Tchan, 1946) is developed after a week.

Methanol, glycerol: Colonies are yellow.

Ethanol: Colonies are creamy.

INFLUENCE OF pH.

Agar media containing Winogradsky salts solution and glucose were buffered to different pH values. (The pH was measured with a glass electrode potentiometer.) The CaCO_3 was replaced by CaCl_2 . The same inoculating technique was used as for the study with different carbon sources.

At values up to pH 6.2 all cultures gave a positive growth within three days. At pH 5.6 *Azotoc. agilis*, *Azot. vinelandii*, *Azot. chroococcum*, *Azot. beijerinckii* gave only very slight growth after ten days. At pH 5.4 all four species failed to grow even after one month, only the new variety and the two species of *Beijerinckia* forming colonies. At pH 4.75 the new variety showed slight growth after five days, but between this pH and pH 3.5 only *Beijerinckia* grew.

Little or no acid was formed on the different media.

DISCUSSION AND CONCLUSION.

There has been no recent study on *Azot. beijerinckii* and the present work can fill this gap in part. It shows that the genus *Azotobacter* contains one non-motile species. If we accept the conception that the non-motile bacteria have no flagellae then the definition of the genus "*Azotobacter*" given in Bergey's Manual should be modified. (Further electronic microscopical study is needed to clarify this point.) The positive acid-fast stain for all species of *Azotobacter* may relate them to the Mycobacteria. It may have some taxonomic significance.

The limits of a pH of 5.8 for *Azotobacter* could not be confirmed in the present study (Pochon and Tchan, 1948). On the other hand, these results are in accordance with Blinkow's work (1951), which showed a critical pH of 5.5-5.6 for the well-known species, but with the new variety the limiting pH is 4.75, which is nearly one unit below that for the other species. This tolerance to acid conditions is important in two ways. When other *Azotobacter* are excluded from acid soils this organism may grow and play a role in the N economy. On the other hand, Derr's acid medium does not exclude it unless modified to give a pH of 4.5 or better 4.0.

Morphologically this organism is an *Azotobacter*, very similar to *Azot. beijerinckii*. Therefore, it cannot be raised to specific rank. Since the remarkable tolerance to acid conditions is unusual, it is proposed to distinguish it as a new variety, *Azotobacter beijerinckii acido-tolerans* (Tchan, 1952), var. nov.

ACKNOWLEDGEMENT.

My sincere thanks are due to Dr. H. S. McKee for his help.

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STUDIES OF N-FIXING BACTERIA. IV.

TAXONOMY OF GENUS AZOTOBACTER (BEIJERINCK, 1901).

By Y. T. TCHAN, Macleay Bacteriologist to the Society.

[Read 24th June, 1953.]

Synopsis.

The confusion in the taxonomy of *Azotobacter* is created by the contradiction between morphology, serology, physiology and chemical composition of different species. A critical examination of different arguments leads to a rearrangement of the family of Azotobacteriaceae. The classification is based on the combined morphological, physiological and ecological characters.

The genus *Azotobacter* Beijerinck, 1901, originally contained two species—*Azot. chroococcum* and *Azot. agilis* (Beijerinck, 1901). In 1903 Lipman (1903) isolated *Azot. vinelandii*, in 1904 *Azot. beijerinckii* and *Azot. woodstownii*, in 1909 *Azot. hilgardii*. Lipman and Burgess (1915) isolated *Azot. smyrnii*. *Azot. vitreum* was isolated by Löhnis and Westermann (1908). This early period of "splitters" was followed by a "lumper" period. Greene (1935), Aso and Yoshida (1928), Löhnis and Smith (1923), and Smith (1948) all reduced the genus *Azotobacter* to two species—*Azot. chroococcum* and *Azot. agilis*. Recent publications have added some new species: *Azot. indicum* Starkey and De (1939), *Azot. insigne* Derx (1950), *Azot. lactiogenes* Kauffmann and Toussaint (1951), and two new varieties: *Azot. agilis* var. *atypica* Kluyver and Van den Bont (1936), *Azot. beijerinckii* var. *acido-tolerans* Tchan (1953).

Winogradsky (1938) recognized four good species of *Azotobacter*: *Azot. agilis*, *Azot. vinelandii*, *Azot. chroococcum*, and *Azot. beijerinckii*. Most authors are agreed that *Azot. woodstownii*, *Azot. hilgardii*, *Azot. smyrnii* and *Azot. vitreum* cannot be regarded as species.

The arguments for reducing the number of species in the genus *Azotobacter* are more or less unsatisfactory.

(1) According to Greene (1935) a significant difference could be found in the amount of hemicellulose, crude protein and ash for the *agilis-vinelandii* group, and a greater content of lignin-like material for the *chroococcum-beijerinckii* group. It is doubtful whether these differences have a real value in identifying *Azot. agilis-Azot. vinelandii* and *Azot. chroococcum-Azot. beijerinckii*. Using Greene's Table 4, we can

calculate the ratio $\frac{\text{Basic N}}{\text{Humins N}}$ for the four species. They give respectively 2.05 (*agilis*), 2.08 (*chroococcum*), 1.90 (*beijerinckii*) and 1.46 (*vinelandii*), using the same reasoning as Greene (1935). This would lead to quite a different conclusion regarding the classification of these species.

(2) According to Aso and Yoshida (1928) the genus *Azotobacter* is grouped into three serological types, i.e. *Azot. chroococcum* type (*chroococcum-beijerinckii*), *Azot. vinelandii* type, *Azot. vitreum* type; *Azot. agilis* was not tested. The data from Aso and Yoshida already showed some slight difference between *Azot. chroococcum* and *Azot. beijerinckii*. They concluded that *Azot. beijerinckii* is a variety of *Azot. chroococcum*, but regarded *Azot. vitreum* as a distinct species. According to Löhnis and Smith, *Azot. vitreum* is a variety of *Azot. agilis*, therefore we should expect that *Azot. agilis* could be serologically different from *Azot. vinelandii*. This is contrary to Greene's chemical hypothesis, and to evidence produced by Löhnis *et al.* in their identifications. However, as we know that serological tests are much more sensitive than chemical analysis, we still cannot accept the serological test without reservations. Immuno-chemistry has shown that the production of antibodies by an animal does

not necessarily involve the whole structure of the antigenic protein. Landsteiner (1939) has shown that the specificity of an antiserum can be affected by a specific group or a compound. So it is possible to detect two different organisms by the same serum if the hapten responsible for the production of antibodies is the same in both. It is well known that the agglutination test for the *Rickettsia prowazekii* can be carried out with *B. proteus OXI9* as antigen. Also for *Tryp. pallidum*, the antigen in the complement fixation test is extracted from ox heart. Such tests therefore cannot determine identity. Serological tests are not to be neglected, but cannot override other characters.

The mutation of $R \rightleftharpoons S$ in bacterial culture is well known, and Kyle and Eisenstark (1951) report that Smith and Hofer regard *Azot. beijerinckii* as a non-pigmented rough strain of *Azot. chroococcum*. (However, it is well known that *Azot. beijerinckii* produces a yellow pigment!)

Indeed, it is probable that many species occurring in nature differ in ways comparable with the mutation observed in experimental culture. If only one character of a species is affected by a stable mutation in natural conditions, it is convenient to regard the new organism as a variety of the species. If the variation affects several characters, a new species should be logically accepted. This is not the place to discuss the genetic variations, but these considerations may prove useful as a working tool for taxonomy of the genus *Azotobacter*.

Morphological and physiological differences of the species of *Azotobacter* have been described by Beijerinck (1901), Lipman (1903), and more recently by Winogradsky (1938) and Starkey (1939). In this paper only a few characteristic and important points are discussed.

MORPHOLOGICAL DIFFERENCES.

Azot. chroococcum and *Azot. beijerinckii* differ in size. There is no doubt that *Azot. beijerinckii* is bigger. Both contain fatty bodies in the cell, but *Azot. beijerinckii* has so many that the cytoplasm is reduced to a minimum. Motility is absent in *Azot. beijerinckii*, which may affect the presence of flagellae and also the lack of H antigen.

Azot. vinelandii and *Azot. agilis* also differ in size and form. The most remarkable character is the absence of cyst formation in *Azot. agilis*. This peculiarity is important with regard to its ecological conditions and taxonomy. Winogradsky (1938) considers *Azot. agilis* a separate genus, *Azomonas*. This generic name is not suitable because *azo* in French does not mean nitrogen.

PHYSIOLOGICAL DIFFERENCES.

Azot. chroococcum produces a brown-black pigment and *Azot. beijerinckii* produces a yellow one. The cell suspensions in liquid media are also different (Tchan, 1953).

Azot. vinelandii uses mannitol and benzoate, but *Azot. agilis* does not. Both grow in the presence of 1% of benzoate in their culture media. This peculiarity has been used successfully by Derx (1950-51) to cultivate specifically these two species in the presence of other species of *Azotobacter*.

A new species of *Azotobacter*, *Azot. insigne* Derx, 1952, is different from these four species. It is rod or oval shaped, $3.1 \times 1.9\mu$, very motile, with cilia directly visible under the dark-field microscope. The cilia are rigid or nearly so, and are $5-6\mu$ in length. The cells contain refractive bodies. This species does not use glucose, mannitol or benzoate. On media with ethanol, a blue-greyish colour is formed which later becomes violet.

Recent papers described acid-forming species of *Azotobacter*—*Azot. indicum* (Starkey and De, 1939) and *Azot. lactiogenes* (Kauffmann and Toussaint, 1951). These species should not be referred to *Azotobacter*.

(1) There is no reason why all aerobic non-symbiotic N-fixing bacteria should be classified in one genus. Aerobic cellulose-decomposing bacteria are classified into different genera, disregarding the common character of decomposing cellulose (Tchan, Pochon and Prévot, 1948).